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METHOD AND DEVICE FOR REGENERATING WOBBLE SIGNAL OF OPTICAL DISK

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Abstract

PROBLEM TO BE SOLVED: To always regenerate a precise wobble signal with simple constitution.
SOLUTION: A quadripartite photodetector 11 is divided into two parts in the left/right directions of a track on an optical disk, and the level of a composite signal V1 outputted from one side photodetectors 11a, 11b is changed based on a control voltage Vcon. A difference signal V5 having the level of a difference between the level-changed signal V4 and the level of the composite signal V2 outputted from the other side photodetectors 11c, 11d is generated, and the difference signal V5 is made the control voltage Vcon through a low-pass filter 34 when an EFM signal is a high level based on the EFM signal regenerated from an RF signal obtained from reflection light from an optical disk, and the difference signal V5 is regenerated as the wobble signal WB through a band-pass filter 35. Thus, the wobble signal without noise and EFM signal components is regenerated.

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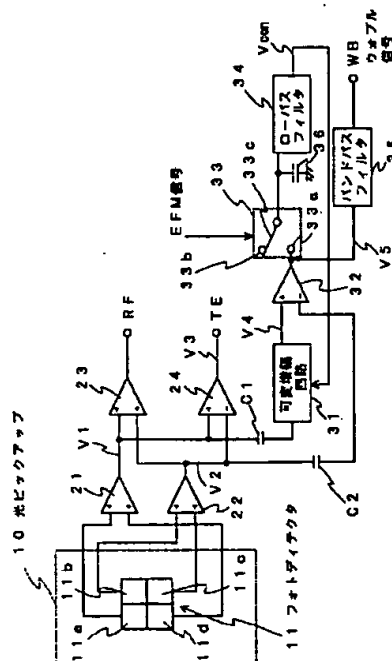
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(54) 【発明の名称】 光ディスクのウォブル信号再生方法及びその装置

(57) 【要約】

【課題】 簡単な構成により常に正確なウォブル信号を再生できる光ディスクのウォブル信号再生方法及びその装置を提供する。

【解決手段】 4分割されたフォトディテクタ11を光ディスクのトラックの左右方向に2分割し、一方の側のフォトディテクタ11a, 11bから出力される合成信号V1のレベルを制御電圧Vconに基づいて変化させ、このレベル変化された信号V4と他方の側のフォトディテクタ11c, 11dから出力される合成信号V2のレベルとの差のレベルを有する差信号V5を生成し、光ディスクの反射光から得られたRF信号から再生されたEFM信号に基づいて、EFM信号がハイレベルのときに差信号V5をローパスフィルタ34を通して制御電圧Vconとなし、差信号V5をバンドパスフィルタ35を通してウォブル信号WBとして再生する。これにより、ノイズ及びEFM信号成分を含まないウォブル信号を再生できる。



【特許請求の範囲】

【請求項1】 絶対時間情報に基づいて蛇行して形成されたトラックを有し、該トラックにそってビットが形成された光ディスクからの反射光を少なくとも前記トラックの左右方向に2分割されたフォトディテクタを用いて検出し、該検出結果から前記トラックの蛇行に対応して変化するウォブル信号を再生する光ディスクのウォブル信号再生方法において、

前記2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルを制御信号に基づいて変化させ、

該レベル変化された信号と他方のフォトディテクタから出力される信号のレベルとの差のレベルを有する差信号を生成し、

前記反射光から得られたE F M信号に基づいて、前記差信号をサンプルホールドした後、

該サンプルホールド信号を低域フィルタを通して前記制御信号となし、

前記差信号を帯域フィルタを通してウォブル信号として再生することを特徴とする光ディスクのウォブル信号再生方法。

【請求項2】 絶対時間情報に基づいて蛇行して形成されたトラックを有し、該トラックにそってビットが形成された光ディスクからの反射光を少なくとも前記トラックの左右方向に2分割されたフォトディテクタを用いて検出し、該検出結果から前記トラックの蛇行に対応して変化するウォブル信号を再生する光ディスクのウォブル信号再生方法において、

前記2分割されたフォトディテクタの両方のフォトディテクタから出力される信号のレベルを第1制御信号及び第2制御信号に基づいてそれぞれ変化させ、

該レベル変化された信号レベルの差のレベルを有する差信号を生成し、

前記反射光から得られたE F M信号に基づいて、前記差信号をサンプルホールドした後、

該サンプルホールド信号を低域フィルタを通して前記第1制御信号となすと共に、

該第1制御信号を反転して前記第2制御信号となし、

前記サンプルホールド信号を帯域フィルタを通してウォブル信号として再生することを特徴とする光ディスクのウォブル信号再生方法。

【請求項3】 絶対時間情報に基づいて蛇行して形成されたトラックを有し、該トラックにそってビットが形成された光ディスクからの反射光を少なくとも前記トラックの左右方向に2分割されたフォトディテクタを用いて検出し、該検出結果から前記トラックの蛇行に対応して変化するウォブル信号を再生する光ディスクのウォブル信号再生装置において、

前記2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルを制御信号に基づい

て変化させて出力する可変増幅回路と、

前記2分割されたフォトディテクタの他方のフォトディテクタから出力される信号のレベルと前記可変増幅回路の出力信号のレベルとの差のレベルを有する信号を出力する減算回路と、

前記光ディスクからの反射光から得られたE F M信号に基づいて、前記減算回路の出力信号をサンプルホールドするサンプルホールド回路と、

該サンプルホールド回路の出力信号における所定周波数以下の周波数成分のみを前記制御信号として出力する低域フィルタと、

前記減算回路の出力信号を入力し、該信号におけるウォブル信号の周波数を含む所定周波数帯域内の周波数の信号を出力する帯域フィルタとを備えたことを特徴とする光ディスクのウォブル信号再生装置。

【請求項4】 絶対時間情報に基づいて蛇行して形成されたトラックを有し、該トラックにそってビットが形成された光ディスクからの反射光を少なくとも前記トラックの左右方向に2分割されたフォトディテクタを用いて検出し、該検出結果から前記トラックの蛇行に対応して変化するウォブル信号を再生する光ディスクのウォブル信号再生装置において、

前記2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルを第1制御信号に基づいて変化させて出力する第1の可変増幅回路と、

前記2分割されたフォトディテクタの他方のフォトディテクタから出力される信号のレベルを第2制御信号に基づいて変化させて出力する第2の可変増幅回路と、

前記第1の可変増幅器の出力信号レベルと前記第2の可変増幅回路の出力信号レベルとの差のレベルを有する信号を出力する減算回路と、

前記光ディスクからの反射光から得られたE F M信号に基づいて、前記減算回路の出力信号をサンプルホールドするサンプルホールド回路と、

該サンプルホールド回路の出力信号における所定周波数以下の周波数成分のみを前記第1制御信号として出力する低域フィルタと、

前記第1制御信号を反転して前記第2制御信号として出力する反転回路と、

前記サンプルホールド回路の出力信号を入力し、該信号におけるウォブル信号の周波数を含む所定周波数帯域内の周波数の信号を出力する帯域フィルタとを備えたことを特徴とする光ディスクのウォブル信号再生装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、光ディスクの情報記録再生装置に用いられるウォブル信号再生方法及びその装置に関するものである。

【0002】

【従来の技術】従来、追記型光ディスク(CD-WO)

等の記録可能な光ディスク1には、図2に示すようにその記録領域に予め僅かな振幅でうねっている(蛇行している)トラック2がスパイラル状に形成されている。このトラックのうねりは、ATIP (Absolute Time In Pregroove) データと呼ばれる絶対時間情報を表すものであり、22.05kHzを基本周波数とし、その周波数はATIPデータの1ビットに対応する長さ(周波数44.1kHzの7周期分)毎にビットの内容、即ちこのビットが「1」であるか「0」であるかに応じて ± 1 kHz変化するようF SK (Frequency Shift Keying) 変調されている。

【0003】また、ATIPデータは、1フレームが1定数(84ビット)のビットを含み且つ所定の位置に固定パターンのフレーム同期信号を備えたビット列からなる多数の連続したフレームで構成され、各フレームは周波数75 Hzの周期で繰り返されている。

【0004】一方、前述した記録可能な光ディスクに音声、映像等の情報を記録する場合は、曲のチャンネル数、プリエンファシスの有無、曲の番号、曲の始まりからの時間、ディスク最内周からの絶対時間等を表す制御情報、即ちサブコードデータも同時に記録される。このサブコードデータは、1フレームが一定数(98ビット)のビット(但し、1ビットに対応する単位長さはATIPデータの場合とは異なる)を含み且つ所定の位置に固定パターンのフレーム同期信号を備えたビット列からなる多数のフレームで構成され、各フレームは周波数75 Hzの周期で記録される。

【0005】ここで、実際に光ディスクに情報を記録する場合には、ATIPデータとサブコードデータとをフレーム同期させて記録しなければならないことが規格により定められているため、ATIPデータを再生する必要がある。このため、従来ATIPデータを再生する際には、前述したうねりを検出してうねりの周期を有するアナログ信号(ウォブル信号)として再生し、アナログPLL回路等を用いたF SK復調回路によって復調を行っていた。

【0006】しかし、ウォブル信号の再生においては、次のような問題点があった。

【0007】即ち、トラッキング誤差信号は、光ピックアップのフォトディテクタ上で光ディスクより反射された戻り光の左右の差を取ったものである。従って、対物レンズが光ディスクの偏芯に追従して移動した場合、当然光ピックアップ内のフォトディテクタ上でも戻り光のスポットは左右に移動する。ここで、戻り光にノイズがある場合を考えると、各フォトディテクタへの入射光強度が全て同レベルであるならば、トラッキング誤差信号にノイズが重畳することはないが、左右の入射光強度のレベルが異なるときは、トラッキング誤差信号にノイズやE FM信号成分が重畳して、ウォブル信号WBのC/Nを低下させてしまう。

【0008】例えば、前述したような追記型の光ディス

クには、情報が記録された領域と、未記録の領域が存在し、情報が記録されている領域においてウォブル信号を再生する場合、光ディスクに偏芯等があればウォブル信号に記録情報の信号成分、即ちE FM信号成分が重畳してC/Nを低下させ、正確にATIPデータを再生できず、サーチに大きな支障をきたして動作不良を引き起こしてしまう。

【0009】このような、動作不良を低減するために、例えば、1ビームプッシュアップ法では、特開平6-44568号公報に開示されるような回路構成でウォブル信号を再生していた。

【0010】即ち、ウォブル信号再生装置は、図3に示すように、加算器71A、71B、減算器72A、72B、結合コンデンサ73A~73C、可変増幅回路74、クランプ回路75A、75B、ピークホールド回路76A、76B、増幅回路77、バンドパスフィルタ(BPF)78から構成されている。

【0011】また、10は光ピックアップで、光ディスクからの反射光を受光するフォトディテクタ11としては、周知の4分割のフォトディテクタ11が用いられている。また、トラックの左側に位置するディテクタ11a、11dの合計受光量及び右側に位置するディテクタ11b、11cの合計受光量に対応する電圧V1、V2が加算増幅器71A、71Bによって生成される。

【0012】ここで、電圧V1、V2においては、光ディスクからの反射光ビームの光量が所定範囲でビットに応じて変化し、且つグループが光ビームの半径方向に変化することにより、所定のレベルだけバイアスされた状態でビットに応じて信号レベルが短い周期で変化し、さらに全体の信号レベルがグループに応じて変動する。

【0013】一方、電圧V1は結合コンデンサ73Aを介して可変増幅回路74に入力され、電圧V2は結合コンデンサ73Bを介して信号S2としてクランプ回路75B及び減算機72Aの非反転入力端子に入力されている。

【0014】また、可変増幅回路74からの出力信号S1は結合コンデンサ73Cを介してクランプ回路75A及び減算機72Aの反転入力端子に入力されている。

【0015】クランプ回路75Aの出力信号はピークホールド回路76Aを介して信号S3として減算機72Bの反転入力端子に入力され、クランプ回路75Bの出力信号はピークホールド回路76Bを介して信号S4として減算機72Bの非反転入力端子に入力されている。さらに、減算機72Bの出力信号S5は増幅器77によって増幅された後、可変増幅回路74に制御信号として入力される。

【0016】また、減算機72Aの出力信号をバンドパスフィルタ78に通すことによってウォブル信号WBを再生している。

【0017】前述の構成によれば、ビットに応じて変化

するRF成分の信号レベルが入力信号S1及びS2間で等しくなるように入力信号S1の信号レベルを補正した後、これらの差信号を生成して、ウォブル信号WBとして再生しているので、光ピックアップ10に対する反射光ビームの入射位置が経年変化等で変化した場合でも、ウォブル信号WBへのRF成分の混入を低減することができる。

【0018】

【発明が解決しようとする課題】しかしながら、前述した従来のウォブル信号再生装置は、構成が複雑であると共10、部品点数が増えてコスト高になるという問題点があった。

【0019】本発明の目的は上記の問題点に鑑み、簡単な構成により常に正確なウォブル信号を再生できる光ディスクのウォブル信号再生方法及びその装置を提供することにある。

【0020】

【課題を解決するための手段】本発明は上記の目的を達成するために請求項1では、絶対時間情報に基づいて蛇行して形成されたトラックを有し、該トラックにそって20 ビットが形成された光ディスクからの反射光を少なくとも前記トラックの左右方向に2分割されたフォトディテクタを用いて検出し、該検出結果から前記トラックの蛇行に対応して変化するウォブル信号を再生する光ディスクのウォブル信号再生方法において、前記2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルを制御信号に基づいて変化させ、該レベル変化された信号と他方のフォトディテクタから出力される信号のレベルとの差のレベルを有する差信号を生成し、前記反射光から得られたEFM信号に基づいて、30 前記差信号をサンプルホールドした後、該サンプルホールド信号を低域フィルタを通して前記制御信号となし、前記差信号を帯域フィルタを通してウォブル信号として再生する光ディスクのウォブル信号再生方法を提案する。

【0021】該光ディスクのウォブル信号再生方法によれば、情報の記録再生対象となる光ディスクからの反射光を受光する2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルは制御信号によってそのレベルが変化される。さらに、このレベル40 変化された信号のレベルと、他方のフォトディテクタから出力された信号のレベルとの差のレベルを有する差信号が生成され、該差信号を帯域フィルタを通すことによりウォブル信号が再生される。ここで、前記制御信号は、光ディスクからの反射光から得られたEFM信号に基づいて前記差信号がサンプルホールドされ、さらに低域フィルタを通して生成され、EFM信号に対応して前記一方のフォトディテクタからの出力信号レベルを変化させ、双方のフォトディテクタからの出力信号レベルのオフセットをほぼ同レベルにしているの、前記2つの

フォトディテクタから出力される双方の信号のノイズ成分、即ち双方の信号において同相であるEFM信号成分が相殺され、ウォブル信号におけるノイズ成分が低減或いは除去される。

【0022】また、請求項2では、絶対時間情報に基づいて蛇行して形成されたトラックを有し、該トラックにそってビットが形成された光ディスクからの反射光を少なくとも前記トラックの左右方向に2分割されたフォトディテクタを用いて検出し、該検出結果から前記トラックの蛇行に対応して変化するウォブル信号を再生する光ディスクのウォブル信号再生方法において、前記2分割されたフォトディテクタの両方のフォトディテクタから出力される信号のレベルを第1制御信号及び第2制御信号に基づいてそれぞれ変化させ、該レベル変化された信号レベルの差のレベルを有する差信号を生成し、前記反射光から得られたEFM信号に基づいて、前記差信号をサンプルホールドした後、該サンプルホールド信号を低域フィルタを通して前記第1制御信号となすと共に、該第1制御信号を反転して前記第2制御信号となし、前記40 サンプルホールド信号を帯域フィルタを通してウォブル信号として再生する光ディスクのウォブル信号再生方法を提案する。

【0023】該光ディスクのウォブル信号再生方法によれば、情報の記録再生対象となる光ディスクからの反射光を受光する2分割されたフォトディテクタの双方のフォトディテクタから出力される信号のレベルは第1及び第2制御信号によってそのレベルが変化される。また、このレベル変化された信号レベルの差のレベルを有する差信号が生成され、該差信号を光ディスクからの反射光から得られたEFM信号に基づいてサンプルホールドし、さらに該サンプルホールドした信号を帯域フィルタを通すことによりウォブル信号が再生される。また、前記第1制御信号は前記サンプルホールドされた信号を低域フィルタを通すことにより生成され、前記第2制御信号は前記第1制御信号を反転することにより生成される。ここで、前記第1及び第2制御信号は、EFM信号に基づいてサンプルホールドされて生成され、EFM信号に対応して前記双方のフォトディテクタからの出力信号レベルを変化させ、双方のフォトディテクタからの出力信号レベルのオフセットをほぼ同レベルにしているの、前記2つのフォトディテクタから出力される双方の信号のノイズ成分、即ち双方の信号において同相であるEFM信号成分が相殺され、ウォブル信号におけるノイズ成分が低減或いは除去されると共に、再生されるウォブル信号のレベルをほぼ一定レベルに維持可能となる。

【0024】また、請求項3では、絶対時間情報に基づいて蛇行して形成されたトラックを有し、該トラックにそってビットが形成された光ディスクからの反射光を少なくとも前記トラックの左右方向に2分割されたフォトディテクタを用いて検出し、該検出結果から前記トラッ

クの蛇行に対応して変化するウォブル信号を再生する光ディスクのウォブル信号再生装置において、前記2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルを制御信号に基づいて変化させて出力する可変増幅回路と、前記2分割されたフォトディテクタの他方のフォトディテクタから出力される信号のレベルと前記可変増幅回路の出力信号のレベルとの差のレベルを有する信号を出力する減算回路と、前記光ディスクからの反射光から得られたE F M信号に基づいて、前記減算回路の出力信号をサンプルホールドするサンプルホールド回路と、該サンプルホールド回路の出力信号における所定周波数以下の周波数成分のみを前記制御信号として出力する低域フィルタと、前記減算回路の出力信号を入力し、該信号におけるウォブル信号の周波数を含む所定周波数帯域内の周波数の信号を出力する帯域フィルタとを備えた光ディスクのウォブル信号再生装置を提案する。

【0025】該光ディスクのウォブル信号再生装置によれば、情報の記録再生対象となる光ディスクからの反射光を受光する2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルが、制御信号に基づいて可変増幅回路によって変化され、減算回路によって、前記2分割されたフォトディテクタの他方のフォトディテクタから出力される信号のレベルと前記可変増幅回路の出力信号のレベルとの差のレベルを有する差信号が出力される。また、前記減算回路の出力信号における所定周波数以下の周波数成分、即ちオフセット成分のみが、低域フィルタによって前記制御信号として出力される。ここで、前記低域フィルタから出力される制御信号は、光ディスクからの反射光から得られたE F M信号に基づいて前記差信号がサンプルホールドされて生成され、E F M信号に対応して前記一方のフォトディテクタからの出力信号レベルを変化させる。さらに、前記制御信号は、前記光ディスクからの反射光から得られたE F M信号が存在するときのみ前記可変増幅回路から出力される信号と前記他方のフォトディテクタから出力される信号のレベル差に対応したレベルを有する信号となるため、この制御信号によって前記一方のフォトディテクタから出力される信号のレベルを前記他方のフォトディテクタから出力される信号のレベルとほぼ同じになるように制御することによって、前記減算器において双方のノイズ成分が相殺され、前記減算器から出力される信号、即ちウォブル信号におけるノイズ成分が低減或いは除去される。さらに、帯域フィルタによって、前記減算回路の出力信号におけるウォブル信号の周波数を含む所定周波数帯域内の周波数の信号が出力されてウォブル信号が再生される。

【0026】また、請求項4では、絶対時間情報に基づいて蛇行して形成されたトラックを有し、該トラックにそってビットが形成された光ディスクからの反射光を少

なくとも前記トラックの左右方向に2分割されたフォトディテクタを用いて検出し、該検出結果から前記トラックの蛇行に対応して変化するウォブル信号を再生する光ディスクのウォブル信号再生装置において、前記2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルを第1制御信号に基づいて変化させて出力する第1の可変増幅回路と、前記2分割されたフォトディテクタの他方のフォトディテクタから出力される信号のレベルを第2制御信号に基づいて変化させて出力する第2の可変増幅回路と、前記第1の可変増幅器の出力信号レベルと前記第2の可変増幅回路の出力信号レベルとの差のレベルを有する信号を出力する減算回路と、前記光ディスクからの反射光から得られたE F M信号に基づいて、前記減算回路の出力信号をサンプルホールドするサンプルホールド回路と、該サンプルホールド回路の出力信号における所定周波数以下の周波数成分のみを前記第1制御信号として出力する低域フィルタと、前記第1制御信号を反転して前記第2制御信号として出力する反転回路と、前記サンプルホールド回路の出力信号を入力し、該信号におけるウォブル信号の周波数を含む所定周波数帯域内の周波数の信号を出力する帯域フィルタとを備えた光ディスクのウォブル信号再生装置を提案する。

【0027】該光ディスクのウォブル信号再生装置によれば、情報の記録再生対象となる光ディスクからの反射光を受光する2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルが、第1及び第2制御信号に基づいて第1及び第2の可変増幅回路によってそれぞれ変化され、減算回路によって、前記第1及び第2の可変増幅回路の出力信号レベルの差のレベルを有する差信号が出力される。また、前記減算回路の出力信号における所定周波数以下の周波数成分、即ちオフセット成分のみが、低域フィルタによって前記第1制御信号として出力される。ここで、前記低域フィルタから出力される第1制御信号は、光ディスクからの反射光から得られたE F M信号に基づいて前記差信号がサンプルホールドされて生成され、E F M信号に対応して前記一方のフォトディテクタからの出力信号レベルを変化させる。また、前記第2制御信号は反転回路によって前記第1制御信号を反転させることにより生成される。さらに、前記第1及び第2制御信号は、前記光ディスクからの反射光から得られたE F M信号が存在するときのみ前記第1及び第2の可変増幅回路から出力される信号レベルの差に対応したレベルを有する信号となるため、この制御信号によって前記双方のフォトディテクタから出力される信号のレベルをほぼ同じになるように制御することによって、前記減算器において双方のノイズ成分が相殺され、前記減算器から出力される信号、即ちウォブル信号におけるノイズ成分が低減或いは除去されると共に、再生されるウォブル信号のレベルをほぼ一定レベル

に維持可能となる。さらに、帯域フィルタによって、前記サンプルホールド回路の出力信号におけるウォブル信号の周波数を含む所定周波数帯域内の周波数の信号が出力されてウォブル信号が再生される。

【0028】

【発明の実施の形態】以下、図面に基づいて本発明の一実施形態を説明する。図1は本発明の第1の実施形態を示す構成図である。図において、前述した従来例と同一構成部分は同一符号をもって表す。即ち、10は1ビームプッシュアップ法を用いた光ピックアップ、21、22は加算増幅器、23は加算器、24は減算器、31は可変増幅回路、32は減算器、33は電子スイッチ、34はローパスフィルタ(LPF)、35はバンドパスフィルタ(BPF)、36はホールドコンデンサである。

【0029】光ピックアップ10は、周知の4分割のフォトディテクタ11を備え、トラックの左側に位置するディテクタ11a、11dの合計受光量及び右側に位置するディテクタ11b、11cの合計受光量を用いてトラッキング補正を、また対角線上に位置するディテクタ11a、11cの合計受光量及びディテクタ11b、11dの合計受光量を用いて非点収差法等によりフォーカス補正を行えるものである。

【0030】加算増幅器21は光ピックアップ10のフォトディテクタ11a、11dから出力される電圧を入力してこれらを加算した電圧V1を出力し、加算増幅器22は光ピックアップ10のフォトディテクタ11b、11cから出力される電圧を入力してこれらを加算した電圧V2を出力する。

【0031】また、加算器23に電圧V1、V2が入力され、加算器23によってこれらが加算されて読出信号(RF信号)として出力されると共に、電圧V1、V2の差の電圧V3が減算器24にて生成され、この電圧V3がトラッキング誤差信号TEとして出力される。

【0032】さらに、加算増幅器21から出力された電圧V1は、結合コンデンサC1を介して可変増幅回路31に入力され、可変増幅回路31によって、制御電圧Vconに基づいて電圧値が所定値に変えられた電圧V4として減算器32に入力される。減算器32の非反転入力端子には電圧V4が入力され、反転入力端子には結合コンデンサC2を介して電圧V2が入力され、減算器32はこれらの差を差信号V5として出力する。この差信号V5は電子スイッチ33の第1の接点33aに入力されると共にバンドパスフィルタ35に入力される。

【0033】電子スイッチ33の第2の接点33bは開放され、接片33cはローパスフィルタ34の入力端子に接続されると共にホールドコンデンサ36を介して接地されている。また、電子スイッチ33は、RF信号から再生されたEFM信号によって切り替えられ、EFM信号がハイレベルのとき接片33cは第1の接点33aに接続され、ローレベルのとき接片33cは第2の接点

33bに接続される。

【0034】ここで、電子スイッチ33とホールドコンデンサ36によってサンプルホールド回路が構成される。

【0035】差信号V5は、電子スイッチ33を介してローパスフィルタ42に入力されると、ローパスフィルタ34によって差信号V5から所定の周波数、例えば40KHz以下の周波数成分のみが抽出されて、前述した制御電圧Vconとして出力される。

【0036】一方、バンドパスフィルタ35に入力された差信号V5は、バンドパスフィルタ35によって所定の周波数帯域内の周波数成分、即ちウォブル信号の周波数22.05KHzを中心とする所定周波数帯域内の周波数成分のみが抽出され、これがウォブル信号WBとして出力される。

【0037】次に、前述の構成よりなる本実施形態の動作を図4の信号波形図に基づいて説明する。光ディスク上の情報が記録されている、即ちビットが形成されているトラックを再生するとそのRF信号はEFM信号によって変調されたものとなる。従って、RF信号からEFM信号を再生することができる。

【0038】しかし、ウォブル信号の再生に必要とする電圧V1、V2もEFM信号が混入したのとなると共に、電圧V1、V2のレベルは違ったものとなっている。ここで、本実施形態ではこれらの電圧V1、V2に混入するEFM信号成分をが等しくなるように、可変増幅回路31によって電圧V1のレベルを補正した電圧V4を生成し、さらにこの電圧V4と電圧V2との差信号V5を減算器32によって生成することにより、EFM成分の混入しない電圧V5を得て、この電圧V5からウォブル信号を再生している。

【0039】可変増幅器31における電圧V1の補正に当たっては、EFM信号がハイレベルHのときにのみ差信号V5をローパスフィルタ34に入力し、ローパスフィルタ34によって差信号V5の包絡線成分、即ちEFM信号成分を抽出し、これを制御電圧Vconとして電圧V1を補正している。

【0040】従って、図4に示すように電圧V4のレベルは電圧V2のレベルとほぼ同レベルとされるので、電圧V4のノイズ成分及びEFM信号成分と電圧V2のノイズ成分及びEFM信号成分とが相殺され、ノイズ成分及びEFM信号成分が低減或いは除去されたウォブル信号WBが生成される。

【0041】ここで、図4に示す信号波形では制御電圧Vconがプラスなので可変増幅回路31はゲインを下げる方向に動作し、また電圧V4が電圧V2よりも小さいときは制御電圧Vconはマイナスとなるため、可変増幅回路31はゲインを上げる方向に動作する。

【0042】前述したように本実施形態によれば、簡単な構成によって常に正確なウォブル信号WBを再生でき

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るので、スピンドル制御、特にトラッキングオフ時のスピンドル制御を安定して行うことができる。さらに、光ディスクに傾芯或いはスキュー(SKEW)が生じていてもA I T Pデータを正確に再生することができるので、サーチミスを大幅に低減することができる。さらに、光ピックアップの経年変化や光ディスクメディアの特性が変化しても、常にC/Nの最良点に自動的にサーボをかけることができる。

【0043】次に、本発明の第2の実施形態を説明する。図5は本発明の第2の実施形態を示す構成図である。図において、前述した従来例と同一構成部分は同一符号をもって表す。即ち、10は1ビームプッシュアップ法を用いた光ピックアップ、21、22は加算増幅器、23は加算器、24は減算器、41A、41Bは可変増幅回路、42は減算器、43は電子スイッチ、44はホールドコンデンサ、45は差動増幅器、46はローパスフィルタ(LPF)、47は反転増幅器、48はバンドパスフィルタ(BPF)である。

【0044】光ピックアップ10は、周知の4分割のフォトディテクタ11を備え、トラックの左側に位置するディテクタ11a、11dの合計受光量及び右側に位置するディテクタ11b、11cの合計受光量を用いてトラッキング補正を、また対角線上に位置するディテクタ11a、11cの合計受光量及びディテクタ11b、11dの合計受光量を用いて非点収差法等によりフォーカス補正を行えるものである。

【0045】加算増幅器21は光ピックアップ10のフォトディテクタ11a、11dから出力される電圧を入力してこれらを加算した電圧V1を出力し、加算増幅器22は光ピックアップ10のフォトディテクタ11b、11cから出力される電圧を入力してこれらを加算した電圧V2を出力する。

【0046】また、加算器23に電圧V1、V2が入力され、加算器23によってこれらが加算されて読出信号(RF信号)として出力されると共に、電圧V1、V2の差の電圧V3が減算器24にて生成され、この電圧V3がトラッキング誤差信号TEとして出力される。

【0047】さらに、加算増幅器21から出力された電圧V1は、結合コンデンサC1を介して可変増幅回路41Aに入力され、可変増幅回路41Aによって、制御電圧Vcon1に基づいて電圧値が所定値に変えられた電圧Vaとして減算器42の非反転入力端子に入力される。

【0048】また、加算器22から出力された電圧V2は、結合コンデンサC2を介して可変増幅器41Bに入力され、可変増幅器41Bによって、制御電圧Vcon2に基づいて電圧値が所定値に変えられた電圧Vbとして減算器42の反転入力端子に入力される。

【0049】減算器42は入力された電圧Va、Vbの差を差信号Vcとして出力する。この差信号Vcは電子

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タ48の入力端子に入力される。

【0050】電子スイッチ43の第2の接点43bは開放され、接片43cは差動増幅器45の非反転入力端子に接続されると共にホールドコンデンサ44を介して接地されている。また、電子スイッチ43は、RF信号から再生されたEFM信号によって切り替えられ、EFM信号がハイレベルのとき接片43cは第1の接点43aに接続され、ローレベルのとき接片43cは第2の接点43bに接続される。

10 【0051】また、差動増幅器45の出力端子はその反転入力端子に接続されると共にローパスフィルタ46の入力端子に接続されている。

【0052】ここで、電子スイッチ43とホールドコンデンサ44及び差動増幅器45によってサンプルホールド回路が構成される。

【0053】差動増幅器45から出力されるホールド信号Vdは、ローパスフィルタ46に入力されると、ローパスフィルタ46によってホールド信号Vdから所定の周波数、例えば40KHz以下の周波数成分のみが抽出

20 されて、前述した制御電圧Vcon1として出力される。

【0054】さらに、制御電圧Vcon1は反転増幅回路47によってその正負が反転されて制御電圧Vcon2として出力される。

【0055】一方、バンドパスフィルタ48に入力された差信号Vcは、バンドパスフィルタ48によって所定の周波数帯域内の周波数成分、即ちウォブル信号の周波数22.05KHzを中心とする所定周波数帯域内の周波数成分のみが抽出され、これがウォブル信号WBとして出力される。

30 【0056】前述の構成よりなる第2の実施形態によれば、光ディスク上の情報が記録されている、即ちビットが形成されているトラックを再生するとそのRF信号はEFM信号によって変調されたものとなる。従って、RF信号からEFM信号を再生することができる。

【0057】しかし、ウォブル信号の再生に必要とする電圧V1、V2もEFM信号が混入したものとなると共に、電圧V1、V2のレベルは違ったものとなっている。

40 【0058】ここで、本実施形態ではこれらの電圧V1、V2に混入するEFM信号成分が等しくなり且つ所定値以上の電圧レベルが得られるように、可変増幅回路41A、41Bによって電圧V1、V2のレベルを補正した電圧Va、Vbを生成し、さらにこの電圧Va、Vbの差信号Vcを減算器42によって生成することにより、EFM成分の混入しないホールド信号Vdを得て、このホールド信号Vdからウォブル信号を再生している。

【0059】可変増幅器41A、41Bにおける電圧V1、V2の補正に当たっては、EFM信号がハイレベルHのときにのみ差信号Vcをサンプルホールドし、ロー

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パスフィルタ46によってホール信号Vdの包絡線成分、即ちEFM信号成分を抽出し、これを制御電圧Vcon1として電圧V1を補正している。さらに、制御電圧Vcon1を反転して制御電圧Vcon2を得て、これにより電圧V2を補正することにより、可変増幅回路41A、41Bをプッシュプル動作させている。これにより、常に最適な一定レベルでウォブル信号を再生できるようにしている。

【0060】従って、電圧Vaのレベルは電圧Vbのレベルとほぼ同レベルとされるので、電圧Vaのノイズ成分及びEFM信号成分と電圧Vbのノイズ成分及びEFM信号成分とが相殺され、ノイズ成分及びEFM信号成分が低減或いは除去されたウォブル信号WBが生成される。

【0061】前述したように本実施形態によれば、簡単な構成によって常に正確な且つ最適なレベルのウォブル信号WBを再生できるので、スピンドル制御、特にトラッキングオフ時のスピンドル制御を安定して行うことができる。さらに、光ディスクに偏芯或いはスキュー(SKEW)が生じていてもAITPデータを正確に再生することができるので、サーチミスを大幅に低減することができる。さらに、光ピックアップの経年変化や光ディスクメディアの特性が変化しても、常にC/Nの最良点に自動的にサーボをかけることができる。

【0062】尚、前述した第1及び第2の実施形態における構成は一例であり、本願発明がこれに限定されないことは言うまでもないことである。

【0063】

【発明の効果】以上説明したように本発明の請求項1記載の光ディスクのウォブル信号再生方法によれば、EFM信号に同期して、2つのフォトディテクタから出力される双方の信号のノイズ成分、即ちEFM信号成分が相殺され、ウォブル信号におけるノイズ成分が低減或いは除去されるので、常に正確なウォブル信号を再生でき、スピンドル制御、特にトラッキングオフ時のスピンドル制御を安定して行うことができると共に、光ディスクに偏芯或いはSKEWが生じていてもAITPデータを正確に再生することができ、サーチミスを大幅に低減することができる。さらに、光ピックアップの経年変化や光ディスクメディアの特性が変化しても、常にC/Nの最良点に自動的にサーボをかけることができる。

【0064】また、請求項2記載の光ディスクのウォブル信号再生方法によれば、EFM信号に同期して、2つのフォトディテクタから出力される双方の信号のノイズ成分、即ちEFM信号成分が相殺され、ウォブル信号におけるノイズ成分が低減或いは除去されるので、常に正確な最適レベルのウォブル信号を再生でき、スピンドル制御、特にトラッキングオフ時のスピンドル制御を安定して行うことができると共に、光ディスクに偏芯或いはSKEWが生じていてもAITPデータを正確に再生す

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ることができ、サーチミスを大幅に低減することができる。さらに、光ピックアップの経年変化や光ディスクメディアの特性が変化しても、常にC/Nの最良点に自動的にサーボをかけることができる。

【0065】また、請求項3記載の光ディスクのウォブル信号再生装置によれば、簡単な構成によってEFM信号に同期して、ウォブル信号のオフセット成分、即ちEFM信号成分が制御信号とされ、該制御信号によってトラックの左右方向に2分割されたフォトディテクタの一方のフォトディテクタから出力される信号のレベルを他方のフォトディテクタから出力される信号のレベルとほぼ同じになるように制御し、減算器によって双方の信号に重畳しているノイズ成分を相殺しているもので、ウォブル信号におけるノイズ成分を低減或いは除去することができる。これにより、常に正確なウォブル信号を再生できるので、スピンドル制御、特にトラッキングオフ時のスピンドル制御を安定して行うことができる。さらに、光ディスクに偏芯或いはSKEWが生じていてもAITPデータを正確に再生することができるので、サーチミスを大幅に低減することができる。さらに、光ピックアップの経年変化や光ディスクメディアの特性が変化しても、常にC/Nの最良点に自動的にサーボをかけることができる。

【0066】また、請求項4記載の光ディスクのウォブル信号再生装置によれば、簡単な構成によってEFM信号に同期して、ウォブル信号のオフセット成分、即ちEFM信号成分が制御信号とされ、該制御信号によってトラックの左右方向に2分割されたフォトディテクタの双方のフォトディテクタから出力される信号のレベルをほぼ同じになるように制御し、減算器によって双方の信号に重畳しているノイズ成分を相殺しているもので、ウォブル信号におけるノイズ成分を低減或いは除去することができる。これにより、常に正確な最適レベルのウォブル信号を再生できるので、スピンドル制御、特にトラッキングオフ時のスピンドル制御を安定して行うことができる。さらに、光ディスクに偏芯或いはSKEWが生じていてもAITPデータを正確に再生することができるので、サーチミスを大幅に低減することができる。さらに、光ピックアップの経年変化や光ディスクメディアの特性が変化しても、常にC/Nの最良点に自動的にサーボをかけることができるという非常に優れた効果を奏するものである。

【図面の簡単な説明】

【図1】本発明の第1の実施形態を示す構成図

【図2】光ディスクに形成されているトラックを説明する図

【図3】従来例を示す構成図

【図4】本発明の第1の実施形態の動作を説明する信号波形図

【図5】本発明の第2の実施形態を示す構成図

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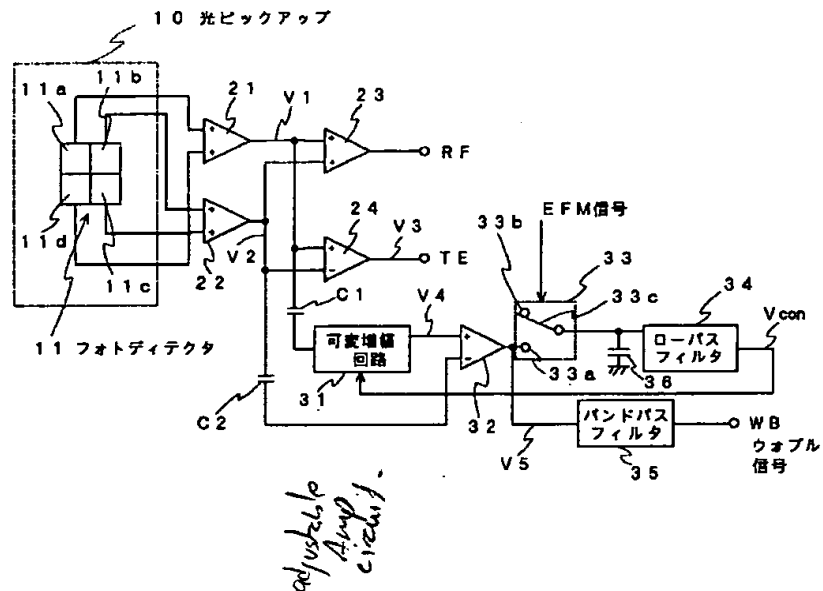
16

【符号の説明】

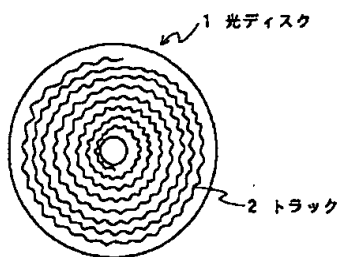
10…光ピックアップ、11a～11d…フォトディテクタ、21、22…加算増幅器、23…加算器、24…減算器、31…可変増幅回路、32…減算器、33…電子スイッチ、34…ローパスフィルタ、35…バンドパス

フィルタ、41A、41B…可変増幅器、42…減算器、43…電子スイッチ、44…ホールドコンデンサ、45…差動増幅器、46…ローパスフィルタ、47…反転増幅器、48…バンドパスフィルタ。

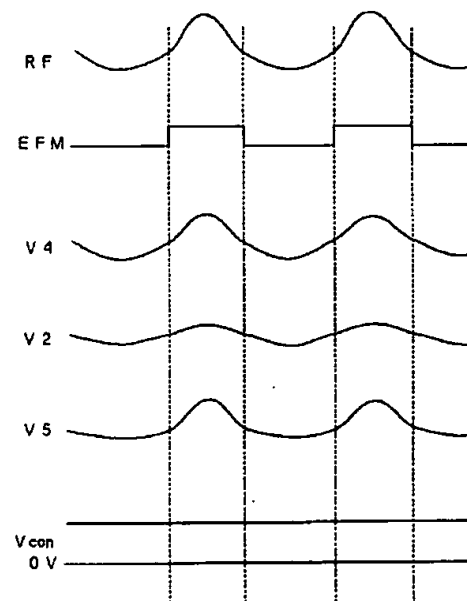
【図1】



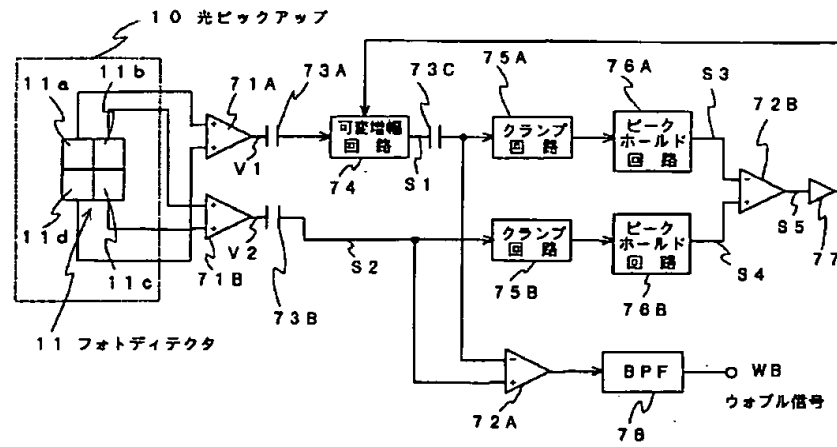
【図2】



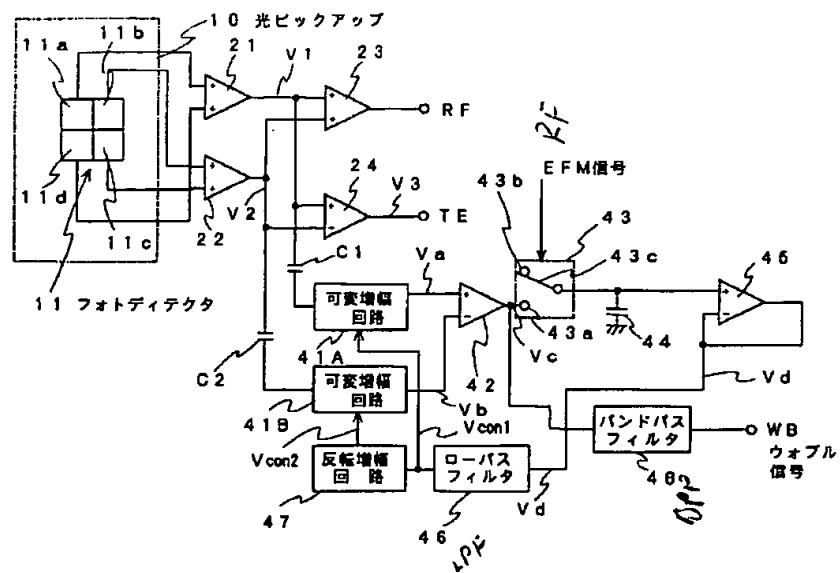
【図4】



【図3】



【図5】



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CLAIMS

[Claim(s)]

[Claim 1] The reflected light from the optical disk with which it has the truck moved in a zigzag direction and formed based on absolute time information, there was along this truck, and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration approach of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck The level of the signal outputted from one photodetector of said photodetector carried out 2 ****s is changed based on a control signal. The difference signal which has the level of a difference with the level of this signal by which level change was carried out, and the signal outputted from the photodetector of another side is generated. After carrying out sample hold of said difference signal based on the EFM signal acquired from said reflected light, The wobble signal regeneration approach of the optical disk characterized by reproducing said control signal, and nothing and said difference signal for this sample hold signal as a wobble signal through a band-pass filter through a low-pass filter.

[Claim 2] The reflected light from the optical disk with which it has the truck moved in a zigzag direction and formed based on absolute time information, there was along this truck, and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration approach of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck The level of the signal outputted from the photodetector of both said photodetectors carried out 2 ****s is changed based on the 1st control signal and the 2nd control signal, respectively. The difference signal which has the level of the difference of this signal level by which level change was carried out is generated. After carrying out sample hold of said difference signal based on the EFM signal acquired from said reflected light, while making this sample hold signal with said 1st control signal through a low-pass filter The wobble signal regeneration approach of the optical disk characterized by reversing this 1st control signal and reproducing said 2nd control signal, and nothing and said sample hold signal as a wobble signal through a band-pass filter.

[Claim 3] The reflected light from the optical disk with which it has the truck moved in a zigzag direction and formed based on absolute time information, there was along this truck, and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration equipment of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck The adjustable amplifying circuit which the level of the signal outputted from one photodetector of said photodetector carried out 2 ****s is changed based on a control signal, and outputs it, The subtractor circuit which outputs the signal which has the level of the difference of the level of the signal outputted from the photodetector of another side of said photodetector carried out 2 ****s, and the level of the output signal of said adjustable amplifying circuit, The sample hold circuit which carries out sample hold of the output signal of said subtractor circuit based on the EFM signal acquired from the reflected light from said optical disk, The low-pass filter which outputs only the frequency component below the predetermined frequency in the output signal of this sample hold circuit as said control signal, Wobble signal regeneration equipment of the optical disk characterized by having the band-pass filter which outputs the signal of the frequency in the predetermined frequency band which inputs the output signal of said subtractor circuit and contains the frequency of the wobble signal in this signal.

(2)
[Claim 4] The reflected light from the optical disk with which it has the truck moved in a zigzag direction and formed based on absolute time information, there was along this truck, and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration equipment of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck The 1st adjustable amplifying circuit which the level of the signal outputted from one photodetector of said photodetector carried out 2 ****s is changed based on the 1st control signal, and outputs it, The 2nd adjustable amplifying circuit which the level of the signal outputted from the photodetector of another side of said photodetector carried out 2 ****s is changed based on the 2nd control signal, and outputs it, The subtractor circuit which outputs the signal which has the level of the difference of the output-signal level of said 1st adjustable amplifier, and the output-signal level of said 2nd adjustable amplifying circuit, The sample hold circuit which carries out sample hold of the output signal of said subtractor circuit based on the EFM signal acquired from the reflected light from said optical disk, The low-pass filter which outputs only the frequency component below the predetermined frequency in the output signal of this sample hold circuit as said 1st control signal, The inverter circuit which reverses said 1st control signal and is outputted as said 2nd control signal, Wobble signal regeneration equipment of the optical disk characterized by having the band-pass filter which outputs the signal of the frequency in the predetermined frequency band which inputs the output signal of said sample hold circuit, and contains the frequency of the wobble signal in this signal.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the wobble signal regeneration approach used for the information record regenerative apparatus of an optical disk, and its equipment.

[0002]

[Description of the Prior Art] As conventionally shown in the recordable optical disk 1 of a write once optical disk (CD-WO) etc. at drawing 2, the track 2 which winds with few amplitude beforehand (it moves in a zigzag direction) is formed in the record section in the shape of a spiral. The wave of this track is ATIP (Absolute Time In Pregroove). The absolute time information called data is expressed, 22.05kHz is made into fundamental frequency, and the FSK (Frequency Shift Keying) modulation of that frequency is carried out so that ± 1 kHz may change according to whether the contents of the bit, i.e., this bit, are "1", or it is "0" to every [corresponding to 1 bit of ATIP data] die length (seven periods with a frequency of 44.1 kHz).

[0003] Moreover, ATIP data consist of frames which a large number which consist of a bit string to which one frame equipped the position with the frame alignment signal of a fixed pattern, including the bit of one constant (84 bits) followed, and each frame is repeated with the period with a frequency of 75Hz.

[0004] On the other hand, when recording information, such as voice and an image, on the recordable optical disk mentioned above, the control information showing the number of channels of music, the existence of pre-emphasis, the number of music, the time amount from the beginning of music, the absolute time from the disk most inner circumference, etc., i.e., sub-code data, is recorded on coincidence. This sub-code data consists of many frames which consist of a bit string to which one frame equipped the position with the frame alignment signal of a fixed pattern, including the bit (however, the unit length corresponding to 1 bit differing from a case with ATIP data) of fixed numbers (98 bits), and each frame is recorded with a period with a frequency of 75Hz.

[0005] Here, to actually record information on an optical disk, since it is defined by specification that frame synchronization of ATIP data and the sub-code data must be carried out, and they must be recorded, it needs to reproduce ATIP data. For this reason, when reproducing ATIP data conventionally, it reproduced as an analog signal (wobble signal) which detects the wave mentioned above and has the period of a wave, and was getting over by the FSK demodulator circuit using an analog PLL circuit etc.

[0006] However, there were the following troubles in playback of a wobble signal.

[0007] That is, a tracking error signal takes the difference of right and left of return light reflected from the optical disk on the photodetector of an optical pickup. Therefore, when an objective lens followed and moves to the eccentricity of an optical disk, naturally the spot of return light moves to right and left also on the photodetector in an optical pickup. Here, although a noise is not overlapped on a tracking error signal if considering the case where a noise is in return light all the incident light reinforcement to each photodetector is these level, when the level of incident light reinforcement on either side differs, a noise and an EFM signal component will be overlapped on a tracking error signal, and C/N of the wobble signal WB will be reduced.

[0008] for example, to the optical disk of a postscript mold which was mentioned above When a wobble signal is reproduced in the field where information was recorded, and the field to which a non-recorded field exists and information is recorded, If eccentricity etc. is in an optical disk, it will be overlapped on

a wobble signal, the signal component, i.e., the EFM signal component, of recording information, and C/N will be reduced, ATIP data will not be able to be reproduced correctly, but big trouble will be caused to a search, and a malfunction will be caused.

[0009] In order to reduce such a malfunction, by the 1 beam push pull method, the wobble signal was reproduced by circuitry which is indicated by JP,6-44568,A.

[0010] That is, wobble signal regeneration equipment consists of Adders 71A and 71B, Subtractors 72A and 72B, coupling capacitors 73A-73C, the adjustable amplifying circuit 74, clamping circuits 75A and 75B, peak hold circuits 76A and 76B, an amplifying circuit 77, and a band pass filter (BPF) 78, as shown in drawing 3.

[0011] Moreover, 10 is an optical pickup and the photodetector 11 of well-known quadrisection is used as a photodetector 11 which receives the reflected light from an optical disk. Moreover, the electrical potential differences V1 and V2 corresponding to the sum total light income of the detectors 11b and 11c located in detectors [which are located in the left-hand side of a track / 11a and 11d] sum total light income and right-hand side are generated by summing amplifiers 71A and 71B.

[0012] Here, in electrical potential differences V1 and V2, when the quantity of light of the reflected light beam from an optical disk changes according to a pit in the predetermined range and a groove changes to radial [of a light beam], where bias only of the predetermined level is carried out, according to a pit, it changes a period with short signal level, and the whole signal level is further changed according to a groove.

[0013] On the other hand, an electrical potential difference V1 is inputted into the adjustable amplifying circuit 74 through coupling-capacitor 73A, and the electrical potential difference V2 is inputted into the non-inversed input terminal of clamping circuit 75B and subtraction machine 72A as a signal S2 through coupling-capacitor 73B.

[0014] Moreover, the output signal S1 from the adjustable amplifying circuit 74 is inputted into the inversed input terminal of clamping circuit 75A and subtraction machine 72A through coupling-capacitor 73C.

[0015] The output signal of clamping circuit 75A is inputted into the inversed input terminal of subtraction machine 72B as a signal S3 through peak hold circuit 76A, and the output signal of clamping circuit 75B is inputted into the non-inversed input terminal of subtraction machine 72B as signal S4 through peak hold circuit 76B. Furthermore, after the output signal S5 of subtraction machine 72B is amplified by amplifier 77, it is inputted into the adjustable amplifying circuit 74 as a control signal.

[0016] Moreover, the wobble signal WB is reproduced by letting the output signal of subtraction machine 72A pass to a band pass filter 78.

[0017] According to the above-mentioned configuration, the signal level of RF component which changes according to a pit is between an input signal S1 and S2, and after amending the signal level of an input signal S1 so that it may become equal, since these difference signals are generated and it is reproducing as a wobble signal WB, even when the incidence location of the reflected light beam to the optical pickup 10 changes by secular change etc., mixing of RF component to the wobble signal WB can be reduced.

[0018]

[Problem(s) to be Solved by the Invention] However, it had the trouble of components mark having increased and becoming cost quantity while the conventional wobble signal regeneration equipment mentioned above had the complicated configuration.

[0019] The purpose of this invention is to offer the wobble signal regeneration approach of the optical disk which can reproduce an always exact wobble signal by the easy configuration, and its equipment in view of the above-mentioned trouble.

[0020]

[Means for Solving the Problem] This invention in order to attain the above-mentioned purpose in claim 1 The reflected light from the optical disk with which it has the track moved in a zigzag direction and formed based on absolute time information, there was along this track, and the pit was formed is detected using the photodetector made into the longitudinal direction of said track 2 ****s at least. In the wobble signal regeneration approach of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said track The level of the signal outputted from one photodetector of said photodetector carried out 2 ****s is changed based on a control signal. The difference signal which has the level of a difference with the level of this signal by

which level change was carried out, and the signal outputted from the photodetector of another side is generated. After carrying out sample hold of said difference signal based on the EFM signal acquired from said reflected light, The wobble signal regeneration approach of the optical disk which reproduces said control signal, and nothing and said difference signal for this sample hold signal as a wobble signal through a band-pass filter through a low-pass filter is proposed.

[0021] As for the level of the signal outputted from one photodetector of the photodetector which receives the reflected light from the optical disk set as the informational record playback object, and which was carried out 2 ****s, according to the wobble signal regeneration approach of this optical disk, the level changes with control signals. Furthermore, the difference signal which has the level of the difference of the level of this signal by which level change was carried out, and the level of the signal outputted from the photodetector of another side is generated, and a wobble signal is reproduced by letting a band-pass filter pass in this difference signal. Based on the EFM signal with which said control signal was acquired from the reflected light from an optical disk, sample hold of said difference signal is carried out here. Since it is furthermore generated through a low-pass filter, the output-signal level from one [said] photodetector is changed corresponding to an EFM signal and offset of the output-signal level from both photodetectors is mostly made into this level. An EFM signal component in phase is offset in the noise component of both signals outputted from said two photodetectors, i.e., both signals, and the noise component in a wobble signal is reduced or removed.

[0022] Moreover, it has the truck moved in a zigzag direction and formed in claim 2 based on absolute time information. The reflected light from the optical disk with which there was it along this truck and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration approach of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck The level of the signal outputted from the photodetector of both said photodetectors carried out 2 ****s is changed based on the 1st control signal and the 2nd control signal, respectively. The difference signal which has the level of the difference of this signal level by which level change was carried out is generated. After carrying out sample hold of said difference signal based on the EFM signal acquired from said reflected light, while making this sample hold signal with said 1st control signal through a low-pass filter The wobble signal regeneration approach of the optical disk which reverses this 1st control signal and reproduces said 2nd control signal, and nothing and said sample hold signal as a wobble signal through a band-pass filter is proposed.

[0023] As for the level of the signal outputted from the photodetector of the both sides of the photodetector which receives the reflected light from the optical disk set as the informational record playback object, and which was carried out 2 ****s, according to the wobble signal regeneration approach of this optical disk, the level changes with the 1st and 2nd control signals. Moreover, the difference signal which has the level of the difference of this signal level by which level change was carried out is generated, sample hold is carried out based on the EFM signal which was able to acquire this difference signal from the reflected light from an optical disk, and a wobble signal is further reproduced by letting a band-pass filter pass in this signal that carried out sample hold. Moreover, said 1st control signal is generated by letting a low-pass filter pass in said signal by which sample hold was carried out, and said 2nd control signal is generated by reversing said 1st control signal. Based on an EFM signal, sample hold of said 1st and 2nd control signals is carried out, and they are generated here. Since the output-signal level from the photodetector of said both sides is changed corresponding to an EFM signal and offset of the output-signal level from both photodetectors is mostly made into this level While an EFM signal component in phase is offset in the noise component of both signals outputted from said two photodetectors, i.e., both signals, and the noise component in a wobble signal is reduced or removed Maintenance on fixed level is almost attained in the level of the wobble signal reproduced.

[0024] Moreover, it has the truck moved in a zigzag direction and formed in claim 3 based on absolute time information. The reflected light from the optical disk with which there was it along this truck and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration equipment of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck The adjustable amplifying circuit which the level of the signal outputted from one photodetector of said photodetector carried out 2 ****s is changed based on a control signal, and outputs it, The subtractor circuit which outputs the signal which has the level of the difference of the level of the signal outputted

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from the photodetector of another side of said photodetector carried out 2 ****s, and the level of the output signal of said adjustable amplifying circuit, The sample hold circuit which carries out sample hold of the output signal of said subtractor circuit based on the EFM signal acquired from the reflected light from said optical disk, The low-pass filter which outputs only the frequency component below the predetermined frequency in the output signal of this sample hold circuit as said control signal, The output signal of said subtractor circuit is inputted and the wobble signal regeneration equipment of the optical disk equipped with the band-pass filter which outputs the signal of the frequency in the predetermined frequency band containing the frequency of the wobble signal in this signal is proposed.

[0025] According to the wobble signal regeneration equipment of this optical disk, the level of the signal outputted from one photodetector of the photodetector which receives the reflected light from the optical disk set as the informational record playback object, and which was carried out 2 ****s It changes with adjustable amplifying circuits based on a control signal, and the difference signal which has the level of the difference of the level of the signal outputted by the subtractor circuit from the photodetector of another side of said photodetector carried out 2 ****s and the level of the output signal of said adjustable amplifying circuit is outputted. Moreover, it is outputted as said control signal with a low-pass filter, the frequency component, i.e., the offset component, below the predetermined frequency in the output signal of said subtractor circuit. Here, based on the EFM signal acquired from the reflected light from an optical disk, sample hold of said difference signal is carried out, it is generated, and the control signal outputted from said low-pass filter changes the output signal level from one [said] photodetector corresponding to an EFM signal. Furthermore, since said control signal turns into a signal outputted from said adjustable amplifying circuit, and a signal which has the level corresponding to the level difference of the signal outputted from the photodetector of said another side only when the EFM signal acquired from the reflected light from said optical disk exists, By controlling the level of the signal outputted from one [said] photodetector by this control signal to become almost the same as the level of the signal outputted from the photodetector of said another side Both noise components are offset in said subtractor, and the noise component in the signal outputted from said subtractor, i.e., a wobble signal, is reduced or removed. Furthermore, with a band-pass filter, the signal of the frequency in the predetermined frequency band containing the frequency of the wobble signal in the output signal of said subtractor circuit is outputted, and a wobble signal is reproduced.

[0026] Moreover, it has the truck moved in a zigzag direction and formed in claim 4 based on absolute time information. The reflected light from the optical disk with which there was it along this truck and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration equipment of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck The 1st adjustable amplifying circuit which the level of the signal outputted from one photodetector of said photodetector carried out 2 ****s is changed based on the 1st control signal, and outputs it, The 2nd adjustable amplifying circuit which the level of the signal outputted from the photodetector of another side of said photodetector carried out 2 ****s is changed based on the 2nd control signal, and outputs it, The subtractor circuit which outputs the signal which has the level of the difference of the output-signal level of said 1st adjustable amplifier, and the output-signal level of said 2nd adjustable amplifying circuit, The sample hold circuit which carries out sample hold of the output signal of said subtractor circuit based on the EFM signal acquired from the reflected light from said optical disk, The low-pass filter which outputs only the frequency component below the predetermined frequency in the output signal of this sample hold circuit as said 1st control signal, The inverter circuit which reverses said 1st control signal and is outputted as said 2nd control signal, The output signal of said sample hold circuit is inputted, and the wobble signal regeneration equipment of the optical disk equipped with the band-pass filter which outputs the signal of the frequency in the predetermined frequency band containing the frequency of the wobble signal in this signal is proposed.

[0027] According to the wobble signal regeneration equipment of this optical disk, the level of the signal outputted from one photodetector of the photodetector which receives the reflected light from the optical disk set as the informational record playback object, and which was carried out 2 ****s changes with the 1st and 2nd adjustable amplifying circuits based on the 1st and 2nd control signals, respectively, and the difference signal which has the level of the difference of the output signal level of said 1st and 2nd adjustable amplifying circuits is outputted by the subtractor circuit. Moreover, it is outputted as said 1st control signal with a low-pass filter, the frequency component, i.e., the offset component, below the

predetermined frequency in the output signal of said subtractor circuit. Here, based on the EFM signal acquired from the reflected light from an optical disk, sample hold of said difference signal is carried out, it is generated, and the 1st control signal outputted from said low-pass filter changes the output signal level from one [said] photodetector corresponding to an EFM signal. Moreover, said 2nd control signal is generated by reversing said 1st control signal by the inverter circuit. Furthermore, since said 1st and 2nd control signals turn into a signal which has the level corresponding to the difference of the signal level outputted from said 1st and 2nd adjustable amplifying circuits only when the EFM signal acquired from the reflected light from said optical disk exists, By controlling the level of the signal outputted from the photodetector of said both sides by this control signal to become almost the same Both noise components are offset in said subtractor, and while the noise component in the signal outputted from said subtractor, i.e., a wobble signal, is reduced or removed, maintenance on fixed level is almost attained in the level of the wobble signal reproduced. Furthermore, with a band-pass filter, the signal of the frequency in the predetermined frequency band containing the frequency of the wobble signal in the output signal of said sample hold circuit is outputted, and a wobble signal is reproduced.

[0028]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained based on a drawing. Drawing 1 is the block diagram showing the 1st operation gestalt of this invention. In drawing, the same component as the conventional example mentioned above is expressed with the same sign. the optical pickup for which 10 used the 1 beam push pull method, and 21 and 22 -- a summing amplifier and 23 -- an adder and 24 -- for a subtractor and 33, as for a low pass filter (LPF) and 35, an electronic switch and 34 are [a subtractor and 31 / an adjustable amplifying circuit and 32 / a band pass filter (BPF) and 36] hold capacitors. [namely,]

[0029] An optical pickup 10 is equipped with the photodetector 11 of well-known quadrisection, and can perform focal amendment by an astigmatism method etc. using the sum total light income of the detectors 11a and 11c located on the diagonal line in tracking amendment again using the sum total light income of the detectors 11b and 11c located in detectors [which are located in the left-hand side of a truck / 11a and 11d] sum total light income and right-hand side, and Detectors [11b and 11d] sum total light income.

[0030] A summing amplifier 21 outputs the electrical potential difference V1 which inputted the electrical potential difference outputted from the photodetectors 11a and 11d of an optical pickup 10, and added these, and outputs the electrical potential difference V2 which the summing amplifier 22 inputted the electrical potential difference outputted from the photodetectors 11b and 11c of an optical pickup 10, and added these.

[0031] Moreover, electrical potential differences V1 and V2 are inputted into an adder 23, while these are added and being outputted as a read-out signal (RF signal) by the adder 23, the electrical potential difference V3 of the difference of electrical potential differences V1 and V2 is generated by the subtractor 24, and this electrical potential difference V3 is outputted as a tracking error signal TE.

[0032] Furthermore, the electrical potential difference V1 outputted from the summing amplifier 21 is inputted into the adjustable amplifying circuit 31 through a coupling capacitor C1, and is inputted into a subtractor 32 as an electrical potential difference V4 on which the electrical-potential-difference value was changed into the predetermined value by the adjustable amplifying circuit 31 based on control voltage Vcon. An electrical potential difference V4 is inputted into the non-inversed input terminal of a subtractor 32, an electrical potential difference V2 is inputted into an inversed input terminal through a coupling capacitor C2, and a subtractor 32 outputs these differences as a difference signal V5. This difference signal V5 is inputted into a band pass filter 35 while it is inputted into 1st contact 33a of an electronic switch 33.

[0033] 2nd contact 33b of an electronic switch 33 is opened wide, and contact piece 33c is grounded through the hold capacitor 36 while connecting with the input terminal of a low pass filter 34. Moreover, an electronic switch 33 is changed by the EFM signal reproduced from the RF signal, when an EFM signal is high-level, contact piece 33c is connected to 1st contact 33a, and contact piece 33c is connected to 2nd contact 33b at the time of a low level.

[0034] Here, a sample hold circuit is constituted by an electronic switch 33 and the hold capacitor 36.

[0035] A predetermined frequency, for example, a frequency component 40kHz or less, will be extracted from the difference signal V5 by the low pass filter 34, and the difference signal V5 will be outputted as control voltage Vcon mentioned above, if inputted into a low pass filter 42 through an

electronic switch 33.

[0036] On the other hand, the frequency component in a predetermined frequency band, i.e., the frequency component in the predetermined frequency band centering on the frequency of 22.05kHz of a wobble signal, is extracted by the band pass filter 35, and, as for the difference signal V5 inputted into the band pass filter 35, this is outputted as a wobble signal WB.

[0037] Next, actuation of this operation gestalt which consists of the above-mentioned configuration is explained based on the signal waveform diagram of drawing 4. Playback of the track in which the information on an optical disk is recorded, namely, the pit is formed modulated the RF signal with the EFM signal. Therefore, an EFM signal is reproducible from a RF signal.

[0038] However, while the electrical potential differences V1 and V2 needed for playback of a wobble signal also become what the EFM signal mixed, the level of electrical potential differences V1 and V2 is the different thing. the EFM signal component mixed in these electrical potential differences V1 and V2 with this operation gestalt here -- ** -- by generating the electrical potential difference V4 which amended the level of an electrical potential difference V1 by the adjustable amplifying circuit 31, and generating the difference signal V5 of this electrical potential difference V4 and electrical potential difference V2 with a subtractor 32 further, the electrical potential difference V5 which an EFM component does not mix is obtained, and the wobble signal is reproduced from this electrical potential difference V5 so that it may become equal.

[0039] In amendment of the electrical potential difference V1 in the adjustable amplifier 31, only when an EFM signal was high level H, the difference signal V5 was inputted into the low pass filter 34, with the low pass filter 34, it extracted, the envelope component, i.e., the EFM signal component, of the difference signal V5, and the electrical potential difference V1 is amended by making this into control voltage Vcon.

[0040] Therefore, since level of an electrical potential difference V4 is mostly made into this level with the level of an electrical potential difference V2 as shown in drawing 4, the noise component of an electrical potential difference V4 and an EFM signal component, the noise component of an electrical potential difference V2, and an EFM signal component are offset, and the wobble signal WB with which the noise component and the EFM signal component were reduced or removed is generated.

[0041] Here, in the signal wave form shown in drawing 4, since control voltage Vcon is plus, the adjustable amplifying circuit 31 operates in the direction which lowers gain, and when an electrical potential difference V4 is smaller than an electrical potential difference V2, since control voltage Vcon is subtracted, it operates in the direction to which the adjustable amplifying circuit 31 raises gain.

[0042] Since the always exact wobble signal WB is reproducible with an easy configuration according to this operation gestalt as mentioned above, it is stabilized and spindle control, especially spindle control at the time of tracking-off can be performed. Furthermore, since AITP data are correctly reproducible even if eccentricity or a skew (SKEW) has arisen in the optical disk, a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0043] Next, the 2nd operation gestalt of this invention is explained. Drawing 5 is the block diagram showing the 2nd operation gestalt of this invention. In drawing, the same component as the conventional example mentioned above is expressed with the same sign. the optical pickup for which 10 used the 1 beam push pull method, and 21 and 22 -- a summing amplifier and 23 -- an adder and 24 -- a subtractor, and 41A and 41B -- an adjustable amplifying circuit and 42 -- for a hold capacitor and 45, as for a low pass filter (LPF) and 47, the differential amplifier and 46 are [a subtractor and 43 / an electronic switch and 44 / an inversed amplifier and 48] band pass filters (BPF). [namely,]

[0044] An optical pickup 10 is equipped with the photodetector 11 of well-known quadrisection, and can perform focal amendment by an astigmatism method etc. using the sum total light income of the detectors 11a and 11c located on the diagonal line in tracking amendment again using the sum total light income of the detectors 11b and 11c located in detectors [which are located in the left-hand side of a track / 11a and 11d] sum total light income and right-hand side, and Detectors [11b and 11d] sum total light income.

[0045] A summing amplifier 21 outputs the electrical potential difference V1 which inputted the electrical potential difference outputted from the photodetectors 11a and 11d of an optical pickup 10, and added these, and outputs the electrical potential difference V2 which the summing amplifier 22 inputted the electrical potential difference outputted from the photodetectors 11b and 11c of an optical

pickup 10, and added these.

[0046] Moreover, electrical potential differences V1 and V2 are inputted into an adder 23, while these are added and being outputted as a read-out signal (RF signal) by the adder 23, the electrical potential difference V3 of the difference of electrical potential differences V1 and V2 is generated by the subtractor 24, and this electrical potential difference V3 is outputted as a tracking error signal TE.

[0047] Furthermore, the electrical potential difference V1 outputted from the summing amplifier 21 is inputted into adjustable amplifying-circuit 41A through a coupling capacitor C1, and is inputted into the non-inversed input terminal of a subtractor 42 as an electrical potential difference Va on which the electrical-potential-difference value was changed into the predetermined value by adjustable amplifying-circuit 41A based on control voltage Vcon1.

[0048] Moreover, the electrical potential difference V2 outputted from the adder 22 is inputted into adjustable amplifier 41B through a coupling capacitor C2, and is inputted into the inversed input terminal of a subtractor 42 as an electrical potential difference Vb on which the electrical-potential-difference value was changed into the predetermined value by adjustable amplifier 41B based on control voltage Vcon2.

[0049] A subtractor 42 outputs the difference of the inputted electrical potential differences Va and Vb as a difference signal Vc. This difference signal Vc is inputted into the input terminal of the 1st contact 43a of an electronic switch 43, and a band pass filter 48.

[0050] 2nd contact 43b of an electronic switch 43 is opened wide, and contact piece 43c is grounded through the hold capacitor 44 while connecting with the non-inversed input terminal of the differential amplifier 45. Moreover, an electronic switch 43 is changed by the EFM signal reproduced from the RF signal, when an EFM signal is high-level, contact piece 43c is connected to 1st contact 43a, and contact piece 43c is connected to 2nd contact 43b at the time of a low level.

[0051] Moreover, the output terminal of the differential amplifier 45 is connected to the input terminal of a low pass filter 46 while connecting with the inversed input terminal.

[0052] Here, a sample hold circuit is constituted by an electronic switch 43, the hold capacitor 44, and the differential amplifier 45.

[0053] A predetermined frequency, for example, a frequency component 40kHz or less, will be extracted from a hold signal Vd by the low pass filter 46, and the hold signal Vd outputted from the differential amplifier 45 will be outputted as control voltage Vcon1 mentioned above, if inputted into a low pass filter 46.

[0054] Furthermore, the positive/negative is reversed by inversed amplification 47 and control voltage Vcon1 is outputted as control voltage Vcon2.

[0055] On the other hand, the frequency component in a predetermined frequency band, i.e., the frequency component in the predetermined frequency band centering on the frequency of 22.05kHz of a wobble signal, is extracted by the band pass filter 48, and, as for the difference signal Vc inputted into the band pass filter 48, this is outputted as a wobble signal WB.

[0056] According to the 2nd operation gestalt which consists of the above-mentioned configuration, when the track in which the information on an optical disk is recorded, namely, the pit is formed was reproduced, the RF signal was modulated by the EFM signal. Therefore, an EFM signal is reproducible from a RF signal.

[0057] However, while the electrical potential differences V1 and V2 needed for playback of a wobble signal also become what the EFM signal mixed, the level of electrical potential differences V1 and V2 is the different thing.

[0058] So that the EFM signal component mixed in these electrical potential differences V1 and V2 with this operation gestalt may become equal here and the voltage level beyond a predetermined value may be obtained By generating the electrical potential differences Va and Vb which amended the level of electrical potential differences V1 and V2 by the adjustable amplifying circuits 41A and 41B, and generating the difference signal Vc of these electrical potential differences Va and Vb with a subtractor 42 further The hold signal Vd which an EFM component does not mix is obtained, and the wobble signal is reproduced from this hold signal Vd.

[0059] In amendment of the electrical potential differences V1 and V2 in the adjustable amplifier 41A and 41B, only when an EFM signal was high level H, sample hold of the difference signal Vc was carried out, with the low pass filter 46, it extracted, the envelope component, i.e., the EFM signal component, of a hold signal Vd, and the electrical potential difference V1 is amended by making this

into control voltage Vcon1. Furthermore, when control voltage Vcon1 is reversed, control voltage Vcon2 is obtained and this amends an electrical potential difference V2, push pull actuation of the adjustable amplifying circuits 41A and 41B is carried out. It enables it to reproduce a wobble signal on the fixed level optimal thereby always.

[0060] Therefore, since level of an electrical potential difference Va is mostly made into this level with the level of an electrical potential difference Vb, the noise component of an electrical potential difference Va and an EFM signal component, the noise component of an electrical potential difference Vb, and an EFM signal component are offset, and the wobble signal WB with which the noise component and the EFM signal component were reduced or removed is generated.

[0061] according to [as mentioned above] this operation gestalt -- an easy configuration -- always exact **** -- since the wobble signal WB of the optimal level is reproducible, it is stabilized and spindle control, especially spindle control at the time of tracking-off can be performed. Furthermore, since AITP data are correctly reproducible even if eccentricity or a skew (SKEW) has arisen in the optical disk, a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0062] In addition, the configuration in the 1st and 2nd operation gestalten mentioned above is an example, and it is needless to say that the invention in this application is not limited to this.

[0063]

[Effect of the Invention] As explained above, according to the wobble signal regeneration approach of the optical disk of this invention according to claim 1 Since it is offset synchronizing with an EFM signal, the noise component, i.e., the EFM signal component, of a signal of the both sides outputted from two photodetectors, and the noise component in a wobble signal is reduced or removed While an always exact wobble signal is reproducible, and being stabilized and being able to perform spindle control, especially spindle control at the time of tracking-off Even if eccentricity or SKEW has arisen in the optical disk, AITP data can be reproduced correctly, and a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0064] Moreover, according to the wobble signal regeneration approach of an optical disk according to claim 2 Since it is offset synchronizing with an EFM signal, the noise component, i.e., the EFM signal component, of a signal of the both sides outputted from two photodetectors, and the noise component in a wobble signal is reduced or removed While the wobble signal of the always exact optimal level is reproducible, and being stabilized and being able to perform spindle control, especially spindle control at the time of tracking-off Even if eccentricity or SKEW has arisen in the optical disk, AITP data can be reproduced correctly, and a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0065] Moreover, according to the wobble signal regeneration equipment of an optical disk according to claim 3 It synchronizes with an EFM signal by the easy configuration. The offset component of a wobble signal, Namely, the level of the signal outputted from one photodetector of the photodetector by which the EFM signal component was made the control signal and made the longitudinal direction of a truck 2 ****s with this control signal is controlled to become almost the same as the level of the signal outputted from the photodetector of another side. Since the noise component superimposed on both signals with the subtractor is offset, the noise component in a wobble signal can be reduced or removed. Since a wobble signal exact thereby always is reproducible, it is stabilized and spindle control, especially spindle control at the time of tracking-off can be performed. Furthermore, since AITP data are correctly reproducible even if eccentricity or SKEW has arisen in the optical disk, a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0066] Moreover, according to the wobble signal regeneration equipment of an optical disk according to claim 4 It synchronizes with an EFM signal by the easy configuration. The offset component of a wobble signal, Namely, the level of the signal outputted from the photodetector of the both sides of a photodetector where the EFM signal component was made into the control signal, and was made into the longitudinal direction of a truck 2 ****s by this control signal is controlled to become almost the same. Since the noise component superimposed on both signals with the subtractor is offset, the noise

component in a wobble signal can be reduced or removed. Since the wobble signal of the optimal level exact thereby always is reproducible, it is stabilized and spindle control, especially spindle control at the time of tracking-off can be performed. Furthermore, since AITP data are correctly reproducible even if eccentricity or SKEW has arisen in the optical disk, a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, the effectiveness which was very excellent that a servo can always be automatically applied to the best point of C/N is done so.

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[Translation done.]

*NOTICES *

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the wobble signal regeneration approach used for the information record regenerative apparatus of an optical disk, and its equipment.

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PRIOR ART

[Description of the Prior Art] As conventionally shown in the recordable optical disk 1 of a write once optical disk (CD-WO) etc. at drawing 2, the track 2 which winds with few amplitude beforehand (it moves in a zigzag direction) is formed in the record section in the shape of a spiral. The wave of this track is ATIP (Absolute Time In Pregroove). The absolute time information called data is expressed, 22.05kHz is made into fundamental frequency, and the FSK (Frequency Shift Keying) modulation of that frequency is carried out so that **1kHz may change according to whether the contents of the bit, i.e., this bit, are "1", or it is "0" to every [corresponding to 1 bit of ATIP data] die length (seven periods with a frequency of 44.1kHz).

[0003] Moreover, ATIP data consist of frames which a large number which consist of a bit string to which one frame equipped the position with the frame alignment signal of a fixed pattern, including the bit of one constant (84 bits) followed, and each frame is repeated with the period with a frequency of 75Hz.

[0004] On the other hand, when recording information, such as voice and an image, on the recordable optical disk mentioned above, the control information showing the number of channels of music, the existence of pre-emphasis, the number of music, the time amount from the beginning of music, the absolute time from the disk most inner circumference, etc., i.e., sub-code data, is recorded on coincidence. This sub-code data consists of many frames which consist of a bit string to which one frame equipped the position with the frame alignment signal of a fixed pattern, including the bit (however, the unit length corresponding to 1 bit differing from a case with ATIP data) of fixed numbers (98 bits), and each frame is recorded with a period with a frequency of 75Hz.

[0005] Here, to actually record information on an optical disk, since it is defined by specification that frame synchronization of ATIP data and the sub-code data must be carried out, and they must be recorded, it needs to reproduce ATIP data. For this reason, when reproducing ATIP data conventionally, it reproduced as an analog signal (wobble signal) which detects the wave mentioned above and has the period of a wave, and was getting over by the FSK demodulator circuit using an analog PLL circuit etc.

[0006] However, there were the following troubles in playback of a wobble signal.

[0007] That is, a tracking error signal takes the difference of right and left of return light reflected from the optical disk on the photodetector of an optical pickup. Therefore, when an objective lens followed and moves to the eccentricity of an optical disk, naturally the spot of return light moves to right and left also on the photodetector in an optical pickup. Here, although a noise is not overlapped on a tracking error signal if considering the case where a noise is in return light all the incident light reinforcement to each photodetector is these level, when the level of incident light reinforcement on either side differs, a noise and an EFM signal component will be overlapped on a tracking error signal, and C/N of the wobble signal WB will be reduced.

[0008] for example, to the optical disk of a postscript mold which was mentioned above When a wobble signal is reproduced in the field where information was recorded, and the field to which a non-recorded field exists and information is recorded, If eccentricity etc. is in an optical disk, it will be overlapped on a wobble signal, the signal component, i.e., the EFM signal component, of recording information, and C/N will be reduced, ATIP data will not be able to be reproduced correctly, but big trouble will be caused to a search, and a malfunction will be caused.

[0009] In order to reduce such a malfunction, by the 1 beam push pull method, the wobble signal was reproduced by circuitry which is indicated by JP,6-44568,A.

[0010] That is, wobble signal regeneration equipment consists of Adders 71A and 71B, Subtractors 72A and 72B, coupling capacitors 73A-73C, the adjustable amplifying circuit 74, clamping circuits 75A and 75B; peak hold circuits 76A and 76B, an amplifying circuit 77, and a band pass filter (BPF) 78, as shown in drawing 3 .

(4)

[0011] Moreover, 10 is an optical pickup and the photodetector 11 of well-known quadrisection is used as a photodetector 11 which receives the reflected light from an optical disk. Moreover, the electrical potential differences V1 and V2 corresponding to the sum total light income of the detectors 11b and 11c located in detectors [which are located in the left-hand side of a track / 11a and 11d] sum total light income and right-hand side are generated by summing amplifiers 71A and 71B.

[0012] Here, in electrical potential differences V1 and V2, when the quantity of light of the reflected light beam from an optical disk changes according to a pit in the predetermined range and a groove changes to radial [of a light beam], where bias only of the predetermined level is carried out, according to a pit, it changes a period with short signal level, and the whole signal level is further changed according to a groove.

[0013] On the other hand, an electrical potential difference V1 is inputted into the adjustable amplifying circuit 74 through coupling-capacitor 73A, and the electrical potential difference V2 is inputted into the non-inversed input terminal of clamping circuit 75B and subtraction machine 72A as a signal S2 through coupling-capacitor 73B.

[0014] Moreover, the output signal S1 from the adjustable amplifying circuit 74 is inputted into the inversed input terminal of clamping circuit 75A and subtraction machine 72A through coupling-capacitor 73C.

[0015] The output signal of clamping circuit 75A is inputted into the inversed input terminal of subtraction machine 72B as a signal S3 through peak hold circuit 76A, and the output signal of clamping circuit 75B is inputted into the non-inversed input terminal of subtraction machine 72B as signal S4 through peak hold circuit 76B. Furthermore, after the output signal S5 of subtraction machine 72B is amplified by amplifier 77, it is inputted into the adjustable amplifying circuit 74 as a control signal.

[0016] Moreover, the wobble signal WB is reproduced by letting the output signal of subtraction machine 72A pass to a band pass filter 78.

[0017] According to the above-mentioned configuration, the signal level of RF component which changes according to a pit is between an input signal S1 and S2, and after amending the signal level of an input signal S1 so that it may become equal, since these difference signals are generated and it is reproducing as a wobble signal WB, even when the incidence location of the reflected light beam to the optical pickup 10 changes by secular change etc., mixing of RF component to the wobble signal WB can be reduced.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to the wobble signal regeneration approach of the optical disk of this invention according to claim 1, it synchronizes with an EFM signal, Since it is offset, the noise component, i.e., the EFM signal component, of a signal of the both sides outputted from two photodetectors, and the noise component in a wobble signal is reduced or removed, an always exact wobble signal is reproducible, while being stabilized and being able to perform spindle control, especially spindle control at the time of tracking-off, even if eccentricity or SKEW has arisen in the optical disk, AITP data can be reproduced correctly, and a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0064] Moreover, according to the wobble signal regeneration approach of an optical disk according to claim 2, it synchronizes with an EFM signal, Since it is offset, the noise component, i.e., the EFM signal component, of a signal of the both sides outputted from two photodetectors, and the noise component in a wobble signal is reduced or removed While the wobble signal of the always exact optimal level is reproducible, and being stabilized and being able to perform spindle control, especially spindle control at the time of tracking-off Even if eccentricity or SKEW has arisen in the optical disk, AITP data can be reproduced correctly, and a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0065] Moreover, according to the wobble signal regeneration equipment of an optical disk according to claim 3, it synchronizes with an EFM signal by the easy configuration, The level of the signal outputted from one photodetector of the photodetector by which it was made the control signal, the offset component, i.e., the EFM signal component, of a wobble signal, and it was made the longitudinal direction of a truck 2 ****s with this control signal is controlled to become almost the same as the level of the signal outputted from the photodetector of another side, and since the noise component superimposed on both signals with the subtractor is offset, the noise component in a wobble signal can be reduced or removed. Since a wobble signal exact thereby always is reproducible, it is stabilized and spindle control, especially spindle control at the time of tracking-off can be performed. Furthermore, since AITP data are correctly reproducible even if eccentricity or SKEW has arisen in the optical disk, a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0066] Moreover, according to the wobble signal regeneration equipment of an optical disk according to claim 4, it synchronizes with an EFM signal by the easy configuration, The level of the signal outputted from the photodetector of the both sides of a photodetector where it was made into the control signal, the offset component, i.e., the EFM signal component, of a wobble signal, and it was made into the longitudinal direction of a truck 2 ****s by this control signal is controlled to become almost the same, and since the noise component superimposed on both signals with the subtractor is offset, the noise component in a wobble signal can be reduced or removed. Since the wobble signal of the optimal level exact thereby always is reproducible, it is stabilized and spindle control, especially spindle control at the time of tracking-off can be performed. Furthermore, since AITP data are correctly reproducible even if eccentricity or SKEW has arisen in the optical disk, a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change,

the effectiveness which was very excellent that a servo can always be automatically applied to the best point of C/N is done so.

(16)

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, it had the trouble of components mark having increased and becoming cost quantity while the conventional wobble signal regeneration equipment mentioned above had the complicated configuration.

[0019] The purpose of this invention is to offer the wobble signal regeneration approach of the optical disk which can reproduce an always exact wobble signal by the easy configuration, and its equipment in view of the above-mentioned trouble.

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MEANS

[Means for Solving the Problem] This invention in order to attain the above-mentioned purpose in claim 1 The reflected light from the optical disk with which it has the truck moved in a zigzag direction and formed based on absolute time information, there was along this truck, and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration approach of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck The level of the signal outputted from one photodetector of said photodetector carried out 2 ****s is changed based on a control signal. The difference signal which has the level of a difference with the level of this signal by which level change was carried out, and the signal outputted from the photodetector of another side is generated. After carrying out sample hold of said difference signal based on the EFM signal acquired from said reflected light, The wobble signal regeneration approach of the optical disk which reproduces said control signal, and nothing and said difference signal for this sample hold signal as a wobble signal through a band-pass filter through a low-pass filter is proposed.

[0021] As for the level of the signal outputted from one photodetector of the photodetector which receives the reflected light from the optical disk set as the informational record playback object, and which was carried out 2 ****s, according to the wobble signal regeneration approach of this optical disk, the level changes with control signals. Furthermore, the difference signal which has the level of the difference of the level of this signal by which level change was carried out, and the level of the signal outputted from the photodetector of another side is generated, and a wobble signal is reproduced by letting a band-pass filter pass in this difference signal. Based on the EFM signal with which said control signal was acquired from the reflected light from an optical disk, sample hold of said difference signal is carried out here. Since it is furthermore generated through a low-pass filter, the output-signal level from one [said] photodetector is changed corresponding to an EFM signal and offset of the output-signal level from both photodetectors is mostly made into this level An EFM signal component in phase is offset in the noise component of both signals outputted from said two photodetectors, i.e., both signals, and the noise component in a wobble signal is reduced or removed.

[0022] Moreover, it has the truck moved in a zigzag direction and formed in claim 2 based on absolute time information. The reflected light from the optical disk with which there was it along this truck and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration approach of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck The level of the signal outputted from the photodetector of both said photodetectors carried out 2 ****s is changed based on the 1st control signal and the 2nd control signal, respectively. The difference signal which has the level of the difference of this signal level by which level change was carried out is generated. After carrying out sample hold of said difference signal based on the EFM signal acquired from said reflected light, while making this sample hold signal with said 1st control signal through a low-pass filter The wobble signal regeneration approach of the optical disk which reverses this 1st control signal and reproduces said 2nd control signal, and nothing and said sample hold signal as a wobble signal through a band-pass filter is proposed.

[0023] As for the level of the signal outputted from the photodetector of the both sides of the photodetector which receives the reflected light from the optical disk set as the informational record playback object, and which was carried out 2 ****s, according to the wobble signal regeneration

approach of this optical disk, the level changes with the 1st and 2nd control signals. Moreover, the difference signal which has the level of the difference of this signal level by which level change was carried out is generated, sample hold is carried out based on the EFM signal which was able to acquire this difference signal from the reflected light from an optical disk, and a wobble signal is further reproduced by letting a band-pass filter pass in this signal that carried out sample hold. Moreover, said 1st control signal is generated by letting a low-pass filter pass in said signal by which sample hold was carried out, and said 2nd control signal is generated by reversing said 1st control signal. Based on an EFM signal, sample hold of said 1st and 2nd control signals is carried out, and they are generated here. Since the output-signal level from the photodetector of said both sides is changed corresponding to an EFM signal and offset of the output-signal level from both photodetectors is mostly made into this level. While an EFM signal component in phase is offset in the noise component of both signals outputted from said two photodetectors, i.e., both signals, and the noise component in a wobble signal is reduced or removed. Maintenance on fixed level is almost attained in the level of the wobble signal reproduced. [0024] Moreover, it has the truck moved in a zigzag direction and formed in claim 3 based on absolute time information. The reflected light from the optical disk with which there was it along this truck and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration equipment of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck. The adjustable amplifying circuit which the level of the signal outputted from one photodetector of said photodetector carried out 2 ****s is changed based on a control signal, and outputs it. The subtractor circuit which outputs the signal which has the level of the difference of the level of the signal outputted from the photodetector of another side of said photodetector carried out 2 ****s, and the level of the output signal of said adjustable amplifying circuit. The sample hold circuit which carries out sample hold of the output signal of said subtractor circuit based on the EFM signal acquired from the reflected light from said optical disk. The low-pass filter which outputs only the frequency component below the predetermined frequency in the output signal of this sample hold circuit as said control signal. The output signal of said subtractor circuit is inputted and the wobble signal regeneration equipment of the optical disk equipped with the band-pass filter which outputs the signal of the frequency in the predetermined frequency band containing the frequency of the wobble signal in this signal is proposed. [0025] According to the wobble signal regeneration equipment of this optical disk, the level of the signal outputted from one photodetector of the photodetector which receives the reflected light from the optical disk set as the informational record playback object, and which was carried out 2 ****s. It changes with adjustable amplifying circuits based on a control signal, and the difference signal which has the level of the difference of the level of the signal outputted by the subtractor circuit from the photodetector of another side of said photodetector carried out 2 ****s and the level of the output signal of said adjustable amplifying circuit is outputted. Moreover, it is outputted as said control signal with a low-pass filter, the frequency component, i.e., the offset component, below the predetermined frequency in the output signal of said subtractor circuit. Here, based on the EFM signal acquired from the reflected light from an optical disk, sample hold of said difference signal is carried out, it is generated, and the control signal outputted from said low-pass filter changes the output signal level from one [said] photodetector corresponding to an EFM signal. Furthermore, since said control signal turns into a signal outputted from said adjustable amplifying circuit, and a signal which has the level corresponding to the level difference of the signal outputted from the photodetector of said another side only when the EFM signal acquired from the reflected light from said optical disk exists. By controlling the level of the signal outputted from one [said] photodetector by this control signal to become almost the same as the level of the signal outputted from the photodetector of said another side. Both noise components are offset in said subtractor, and the noise component in the signal outputted from said subtractor, i.e., a wobble signal, is reduced or removed. Furthermore, with a band-pass filter, the signal of the frequency in the predetermined frequency band containing the frequency of the wobble signal in the output signal of said subtractor circuit is outputted, and a wobble signal is reproduced. [0026] Moreover, it has the truck moved in a zigzag direction and formed in claim 4 based on absolute time information. The reflected light from the optical disk with which there was it along this truck and the pit was formed is detected using the photodetector made into the longitudinal direction of said truck 2 ****s at least. In the wobble signal regeneration equipment of the optical disk which reproduces the wobble signal which changes from this detection result corresponding to meandering of said truck. The

1st adjustable amplifying circuit which the level of the signal outputted from one photodetector of said photodetector carried out 2 ****s is changed based on the 1st control signal, and outputs it, The 2nd adjustable amplifying circuit which the level of the signal outputted from the photodetector of another side of said photodetector carried out 2 ****s is changed based on the 2nd control signal, and outputs it, The subtractor circuit which outputs the signal which has the level of the difference of the output-signal level of said 1st adjustable amplifier, and the output-signal level of said 2nd adjustable amplifying circuit, The sample hold circuit which carries out sample hold of the output signal of said subtractor circuit based on the EFM signal acquired from the reflected light from said optical disk, The low-pass filter which outputs only the frequency component below the predetermined frequency in the output signal of this sample hold circuit as said 1st control signal, The inverter circuit which reverses said 1st control signal and is outputted as said 2nd control signal, The output signal of said sample hold circuit is inputted, and the wobble signal regeneration equipment of the optical disk equipped with the band-pass filter which outputs the signal of the frequency in the predetermined frequency band containing the frequency of the wobble signal in this signal is proposed.

[0027] According to the wobble signal regeneration equipment of this optical disk, the level of the signal outputted from one photodetector of the photodetector which receives the reflected light from the optical disk set as the informational record playback object, and which was carried out 2 ****s changes with the 1st and 2nd adjustable amplifying circuits based on the 1st and 2nd control signals, respectively, and the difference signal which has the level of the difference of the output signal level of said 1st and 2nd adjustable amplifying circuits is outputted by the subtractor circuit. Moreover, it is outputted as said 1st control signal with a low-pass filter, the frequency component, i.e., the offset component, below the predetermined frequency in the output signal of said subtractor circuit. Here, based on the EFM signal acquired from the reflected light from an optical disk, sample hold of said difference signal is carried out, it is generated, and the 1st control signal outputted from said low-pass filter changes the output signal level from one [said] photodetector corresponding to an EFM signal. Moreover, said 2nd control signal is generated by reversing said 1st control signal by the inverter circuit. Furthermore, since said 1st and 2nd control signals turn into a signal which has the level corresponding to the difference of the signal level outputted from said 1st and 2nd adjustable amplifying circuits only when the EFM signal acquired from the reflected light from said optical disk exists, By controlling the level of the signal outputted from the photodetector of said both sides by this control signal to become almost the same Both noise components are offset in said subtractor, and while the noise component in the signal outputted from said subtractor, i.e., a wobble signal, is reduced or removed, maintenance on fixed level is almost attained in the level of the wobble signal reproduced. Furthermore, with a band-pass filter, the signal of the frequency in the predetermined frequency band containing the frequency of the wobble signal in the output signal of said sample hold circuit is outputted, and a wobble signal is reproduced.

[0028]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained based on a drawing. Drawing 1 is the block diagram showing the 1st operation gestalt of this invention. In drawing, the same component as the conventional example mentioned above is expressed with the same sign. the optical pickup for which 10 used the 1 beam push pull method, and 21 and 22 -- a summing amplifier and 23 -- an adder and 24 -- for a subtractor and 33, as for a low pass filter (LPF) and 35, an electronic switch and 34 are [a subtractor and 31 / an adjustable amplifying circuit and 32 / a band pass filter (BPF) and 36] hold capacitors. [namely,]

[0029] An optical pickup 10 is equipped with the photodetector 11 of well-known quadrisection, and can perform focal amendment by an astigmatism method etc. using the sum total light income of the detectors 11a and 11c located on the diagonal line in tracking amendment again using the sum total light income of the detectors 11b and 11c located in detectors [which are located in the left-hand side of a truck / 11a and 11d] sum total light income and right-hand side, and Detectors [11b and 11d] sum total light income.

[0030] A summing amplifier 21 outputs the electrical potential difference V1 which inputted the electrical potential difference outputted from the photodetectors 11a and 11d of an optical pickup 10, and added these, and outputs the electrical potential difference V2 which the summing amplifier 22 inputted the electrical potential difference outputted from the photodetectors 11b and 11c of an optical pickup 10, and added these.

[0031] Moreover, electrical potential differences V1 and V2 are inputted into an adder 23, while these

are added and being outputted as a read-out signal (RF signal) by the adder 23, the electrical potential difference V3 of the difference of electrical potential differences V1 and V2 is generated by the subtractor 24, and this electrical potential difference V3 is outputted as a tracking error signal TE. (21)

[0032] Furthermore, the electrical potential difference V1 outputted from the summing amplifier 21 is inputted into the adjustable amplifying circuit 31 through a coupling capacitor C1, and is inputted into a subtractor 32 as an electrical potential difference V4 on which the electrical-potential-difference value was changed into the predetermined value by the adjustable amplifying circuit 31 based on control voltage Vcon. An electrical potential difference V4 is inputted into the non-inversed input terminal of a subtractor 32, an electrical potential difference V2 is inputted into an inversed input terminal through a coupling capacitor C2, and a subtractor 32 outputs these differences as a difference signal V5. This difference signal V5 is inputted into a band pass filter 35 while it is inputted into 1st contact 33a of an electronic switch 33.

[0033] 2nd contact 33b of an electronic switch 33 is opened wide, and contact piece 33c is grounded through the hold capacitor 36 while connecting with the input terminal of a low pass filter 34. Moreover, an electronic switch 33 is changed by the EFM signal reproduced from the RF signal, when an EFM signal is high-level, contact piece 33c is connected to 1st contact 33a, and contact piece 33c is connected to 2nd contact 33b at the time of a low level.

[0034] Here, a sample hold circuit is constituted by an electronic switch 33 and the hold capacitor 36.

[0035] A predetermined frequency, for example, a frequency component 40kHz or less, will be extracted from the difference signal V5 by the low pass filter 34, and the difference signal V5 will be outputted as control voltage Vcon mentioned above, if inputted into a low pass filter 42 through an electronic switch 33.

[0036] On the other hand, the frequency component in a predetermined frequency band, i.e., the frequency component in the predetermined frequency band centering on the frequency of 22.05kHz of a wobble signal, is extracted by the band pass filter 35, and, as for the difference signal V5 inputted into the band pass filter 35, this is outputted as a wobble signal WB.

[0037] Next, actuation of this operation gestalt which consists of the above-mentioned configuration is explained based on the signal waveform diagram of drawing 4. Playback of the track in which the information on an optical disk is recorded, namely, the pit is formed modulated the RF signal with the EFM signal. Therefore, an EFM signal is reproducible from a RF signal.

[0038] However, while the electrical potential differences V1 and V2 needed for playback of a wobble signal also become what the EFM signal mixed, the level of electrical potential differences V1 and V2 is the different thing. the EFM signal component mixed in these electrical potential differences V1 and V2 with this operation gestalt here -- ** -- by generating the electrical potential difference V4 which amended the level of an electrical potential difference V1 by the adjustable amplifying circuit 31, and generating the difference signal V5 of this electrical potential difference V4 and electrical potential difference V2 with a subtractor 32 further, the electrical potential difference V5 which an EFM component does not mix is obtained, and the wobble signal is reproduced from this electrical potential difference V5 so that it may become equal.

[0039] In amendment of the electrical potential difference V1 in the adjustable amplifier 31, only when an EFM signal was high level H, the difference signal V5 was inputted into the low pass filter 34, with the low pass filter 34, it extracted, the envelope component, i.e., the EFM signal component, of the difference signal V5, and the electrical potential difference V1 is amended by making this into control voltage Vcon.

[0040] Therefore, since level of an electrical potential difference V4 is mostly made into this level with the level of an electrical potential difference V2 as shown in drawing 4, the noise component of an electrical potential difference V4 and an EFM signal component, the noise component of an electrical potential difference V2, and an EFM signal component are offset, and the wobble signal WB with which the noise component and the EFM signal component were reduced or removed is generated. ✓

[0041] Here, in the signal wave form shown in drawing 4, since control voltage Vcon is plus, the adjustable amplifying circuit 31 operates in the direction which lowers gain, and when an electrical potential difference V4 is smaller than an electrical potential difference V2, since control voltage Vcon is subtracted, it operates in the direction to which the adjustable amplifying circuit 31 raises gain.

[0042] Since the always exact wobble signal WB is reproducible with an easy configuration according to this operation gestalt as mentioned above, it is stabilized and spindle control, especially spindle

control at the time of tracking-off can be performed. Furthermore, since AITP data are correctly reproducible even if eccentricity or a skew (SKEW) has arisen in the optical disk, a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0043] Next, the 2nd operation gestalt of this invention is explained. Drawing 5 is the block diagram showing the 2nd operation gestalt of this invention. In drawing, the same component as the conventional example mentioned above is expressed with the same sign. the optical pickup for which 10 used the 1 beam push pull method, and 21 and 22 -- a summing amplifier and 23 -- an adder and 24 -- a subtractor, and 41A and 41B -- an adjustable amplifying circuit and 42 -- for a hold capacitor and 45, as for a low pass filter (LPF) and 47, the differential amplifier and 46 are [a subtractor and 43 / an electronic switch and 44 / an inversed amplifier and 48] band pass filters (BPF). [namely,]

[0044] An optical pickup 10 is equipped with the photodetector 11 of well-known quadrisection, and can perform focal amendment by an astigmatism method etc. using the sum total light income of the detectors 11a and 11c located on the diagonal line in tracking amendment again using the sum total light income of the detectors 11b and 11c located in detectors [which are located in the left-hand side of a truck / 11a and 11d] sum total light income and right-hand side, and Detectors [11b and 11d] sum total light income.

[0045] A summing amplifier 21 outputs the electrical potential difference V1 which inputted the electrical potential difference outputted from the photodetectors 11a and 11d of an optical pickup 10, and added these, and outputs the electrical potential difference V2 which the summing amplifier 22 inputted the electrical potential difference outputted from the photodetectors 11b and 11c of an optical pickup 10, and added these.

[0046] Moreover, electrical potential differences V1 and V2 are inputted into an adder 23, while these are added and being outputted as a read-out signal (RF signal) by the adder 23, the electrical potential difference V3 of the difference of electrical potential differences V1 and V2 is generated by the subtractor 24, and this electrical potential difference V3 is outputted as a tracking error signal TE.

[0047] Furthermore, the electrical potential difference V1 outputted from the summing amplifier 21 is inputted into adjustable amplifying-circuit 41A through a coupling capacitor C1, and is inputted into the non-inversed input terminal of a subtractor 42 as an electrical potential difference Va on which the electrical-potential-difference value was changed into the predetermined value by adjustable amplifying-circuit 41A based on control voltage Vcon1.

[0048] Moreover, the electrical potential difference V2 outputted from the adder 22 is inputted into adjustable amplifier 41B through a coupling capacitor C2, and is inputted into the inversed input terminal of a subtractor 42 as an electrical potential difference Vb on which the electrical-potential-difference value was changed into the predetermined value by adjustable amplifier 41B based on control voltage Vcon2.

[0049] A subtractor 42 outputs the difference of the inputted electrical potential differences Va and Vb as a difference signal Vc. This difference signal Vc is inputted into the input terminal of the 1st contact 43a of an electronic switch 43, and a band pass filter 48.

[0050] 2nd contact 43b of an electronic switch 43 is opened wide, and contact piece 43c is grounded through the hold capacitor 44 while connecting with the non-inversed input terminal of the differential amplifier 45. Moreover, an electronic switch 43 is changed by the EFM signal reproduced from the RF signal, when an EFM signal is high-level, contact piece 43c is connected to 1st contact 43a, and contact piece 43c is connected to 2nd contact 43b at the time of a low level.

[0051] Moreover, the output terminal of the differential amplifier 45 is connected to the input terminal of a low pass filter 46 while connecting with the inversed input terminal.

[0052] Here, a sample hold circuit is constituted by an electronic switch 43, the hold capacitor 44, and the differential amplifier 45.

[0053] A predetermined frequency, for example, a frequency component 40kHz or less, will be extracted from a hold signal Vd by the low pass filter 46, and the hold signal Vd outputted from the differential amplifier 45 will be outputted as control voltage Vcon1 mentioned above, if inputted into a low pass filter 46.

[0054] Furthermore, the positive/negative is reversed by inversed amplification 47 and control voltage Vcon1 is outputted as control voltage Vcon2.

[0055] On the other hand, the frequency component in a predetermined frequency band, i.e., the

frequency component in the predetermined frequency band centering on the frequency of 22.05kHz of a wobble signal, is extracted by the band pass filter 48, and, as for the difference signal Vc inputted into the band pass filter 48, this is outputted as a wobble signal WB.

[0056] According to the 2nd operation gestalt which consists of the above-mentioned configuration, when the track in which the information on an optical disk is recorded, namely, the pit is formed was reproduced, the RF signal was modulated by the EFM signal. Therefore, an EFM signal is reproducible from a RF signal.

[0057] However, while the electrical potential differences V1 and V2 needed for playback of a wobble signal also become what the EFM signal mixed, the level of electrical potential differences V1 and V2 is the different thing.

[0058] So that the EFM signal component mixed in these electrical potential differences V1 and V2 with this operation gestalt may become equal here and the voltage level beyond a predetermined value may be obtained By generating the electrical potential differences Va and Vb which amended the level of electrical potential differences V1 and V2 by the adjustable amplifying circuits 41A and 41B, and generating the difference signal Vc of these electrical potential differences Va and Vb with a subtractor 42 further The hold signal Vd which an EFM component does not mix is obtained, and the wobble signal is reproduced from this hold signal Vd.

[0059] In amendment of the electrical potential differences V1 and V2 in the adjustable amplifier 41A and 41B, only when an EFM signal was high level H, sample hold of the difference signal Vc was carried out, with the low pass filter 46, it extracted, the envelope component, i.e., the EFM signal component, of a hold signal Vd, and the electrical potential difference V1 is amended by making this into control voltage Vcon1. Furthermore, when control voltage Vcon1 is reversed, control voltage Vcon2 is obtained and this amends an electrical potential difference V2, push pull actuation of the adjustable amplifying circuits 41A and 41B is carried out. It enables it to reproduce a wobble signal on the fixed level optimal thereby always.

[0060] Therefore, since level of an electrical potential difference Va is mostly made into this level with the level of an electrical potential difference Vb, the noise component of an electrical potential difference Va and an EFM signal component, the noise component of an electrical potential difference Vb, and an EFM signal component are offset, and the wobble signal WB with which the noise component and the EFM signal component were reduced or removed is generated.

[0061] according to [as mentioned above] this operation gestalt -- an easy configuration -- always exact **** -- since the wobble signal WB of the optimal level is reproducible, it is stabilized and spindle control, especially spindle control at the time of tracking-off can be performed. Furthermore, since AITP data are correctly reproducible even if eccentricity or a skew (SKEW) has arisen in the optical disk, a search mistake can be reduced sharply. Furthermore, even if secular change of an optical pickup and the property of optical disk media change, a servo can always be automatically applied to the best point of C/N.

[0062] In addition, the configuration in the 1st and 2nd operation gestalten mentioned above is an example, and it is needless to say that the invention in this application is not limited to this.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the 1st operation gestalt of this invention

[Drawing 2] Drawing explaining the truck currently formed in the optical disk

[Drawing 3] The block diagram showing the conventional example

[Drawing 4] The signal waveform diagram explaining actuation of the 1st operation gestalt of this invention

[Drawing 5] The block diagram showing the 2nd operation gestalt of this invention

[Description of Notations]

10 -- an optical pickup, a 11a-11d-- photodetector, 21, 22 -- summing amplifier, and 23 -- an adder, 24 -- subtractor, a 31 -- adjustable amplifying circuit, and 32 -- a subtractor, 33 -- electronic switch, 34 -- low pass filter, and 35 -- a band pass filter, 41A, a 41B-- adjustable amplifier, 42 -- subtractor, and 43 -- an electronic switch, 44 -- hold capacitor, 45 -- differential amplifier, and 46 -- a low pass filter, 47 -- inversed amplifier, and 48 -- band pass filter.

[Translation done.]